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(54) Title: MEDICATION ADMINISTRATION SYSTEM WITH MEDICATION DISPENSING AND STORING MODULES		
(57) Abstract		
<p>A system for the controlled dispensing and storing of medication and more particularly, a programmed computerized system (21) with various types of medication dispensing units (40) to dispense one or more single units of medication items, according to patient requirements that are programmed into the system (21). A modular medication dispensing unit (40) with its own microprocessor (70) is provided. This medication dispensing unit (40) can be removed from the system (21) or have its power supply turned off and the microprocessor (70) maintains information regarding the type quantity, expiration dates and other relevant information about each medication item in the medication dispensing unit (40).</p>		

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**MEDICATION ADMINISTRATION SYSTEM WITH
MEDICATION DISPENSING AND STORING MODULES**

BACKGROUND AND SUMMARY OF THE INVENTION

The present invention relates generally to a system for the controlled dispensing and storing of medication items and more particularly, to a computerized system with modular medication dispensing units to dispense one or more single units of medication items, according to patient requirements that are programmed into the system, in a manner that is efficient and accurate.

In a hospital, many patients require many different types of medications at different times throughout the day and night. There also may be different levels of communication in the chain of command as to who is to give the medication to the patients, as well as if, and when, the patient received different medication items. There is room for human error in dispensing the proper amount of medication items at the proper times. There is also room for human error as to the proper billing of a patient for the types and amounts of medication items that a patient receives. With a large number of patients and often a short amount of time for each patient, the chance for human error is greater with respect to the proper dosage as well as to the proper billing.

There exists a need for a system that dispenses unit doses of many types and sizes of medication items of the proper type and amount in an efficient, accurate and user-friendly way. Furthermore, there is a need for a time-saving system that keeps accurate records of the patient's medication and billing record. The present invention fulfills these needs and provides further advantages.

In accordance with the present invention, a computerized medication administration system including a cabinet with plurality of medication dispensing drawers and compartments

is provided. The medication administration system includes a central processing unit (CPU) that is the "brain" or "interface controller" of the system. At least one of the drawers has compartments and a latch mechanism. The latch mechanism is operatively connected to the CPU and the latch mechanism locks the drawer when the drawer is closed and opens the proper drawer to dispense medication items for a patient when activated by the CPU.

At least one of the compartments in a drawer of the system has a sensor or a pair of sensors to detect the presence or absence of medication items in the compartment and the sensor(s) is operatively connected to the CPU. The CPU is also operatively connected to at least one compartment in a drawer of the system and the CPU enables a user of the system to dispense proper types and quantities of medication items for a particular patient.

The cabinet of the system may also include at least one drawer or compartment that holds one or more modular medication dispensing units. The modular medication dispensing units can easily be disconnected from the system and filled with medication by a pharmacist in a separate location than the system.

In one embodiment of the present invention, the medication administration system comprises a cabinet having a plurality of drawers and compartments, wherein at least one of the compartments is adapted to hold a plurality of modular medication dispensing units. The modular medication dispensing units can easily be disconnected from the system and filled with medication by a pharmacist in a separate location than the system. A modular medication dispensing unit comprises a housing having a top, bottom, front, back and two sides, with the top having an opening to allow medication items to be inserted therein by a pharmacist. The bottom of the housing has an opening to allow medication items to be dispensed therefrom. The modular medication dispensing unit also has a first shaft with each

end rotatably secured to the sides of the housing, such that the first shaft can be easily rotated along its axis. The dispensing unit also has a second shaft with each end rotatably secured to the sides of the housing, such that the second shaft can be easily rotated along its axis. The dispensing unit includes a conveyor-type continuous loop of a plurality of shelves passing over the first and second shafts and a motor, operatively connected to the second shaft, to rotate the second shaft along its axis, thereby causing the plurality of shelves to pass over the first and second shafts.

The system also includes a microprocessor connected to the motor to start and stop the plurality of shelves to properly dispense the medication. The microprocessor is also connected to the CPU and information can be transmitted between the microprocessor and the CPU. The microprocessor contains information regarding the medication items stored in the corresponding dispensing unit. The microprocessor is module-specific. At least one of the drawers in the cabinet has a latch mechanism operatively connected to the microprocessor which opens the respective drawers to allow the user to retrieve the appropriate medication after the medication has been dispensed. The microprocessor is connected to the motor of the modular medication dispensing unit to enable the modular medication dispensing unit to be loaded in a controlled manner, and to enable the modular medication dispensing unit to dispense unit doses of medication in a controlled manner for a particular patient, the first programmable processor being capable of receiving and storing information about the respective type, quantity and medication information of each of the unit doses of medication loaded onto an assigned shelf of the modular medication dispensing unit, the information in the first programmable processor being automatically updated when a unit dose of medication is dispensed from the modular medication dispensing unit, and the first programmable

processor containing information about the remaining inventory in the modular medication dispensing unit at any given time.

The medication dispensing unit may further include sensors to detect when a medication item is inserted into the medication dispensing unit, sensors to detect when a medication item is dispensed by the medication dispensing unit, and sensors to detect when a shelf of the medication dispensing unit has a medication item thereon. The sensors are connected to the microprocessor to record the information detected by the sensors, including the number and types of medication items loaded in the medication dispensing units and the number and types of medication items dispensed by the system.

One embodiment of a medication dispensing unit includes a frame, a first shaft with first and second ends with each of the ends being rotatably secured within the frame, and a second shaft with first and second ends with each of the ends rotatably secured within the frame. The medication dispensing unit also includes at least one belt passing over and around the first and second shafts. The medication dispensing unit further includes a housing that is secured to the frame. The housing and the frame enclose all or part of the belt, first shaft and second shaft such that the medication items on the belt will not fall out of the unit until the medication items are dispensed from the unit. The medication dispensing unit includes a motor that is operatively connected to at least one of the shafts to rotate the shaft along its axis. This rotation of the shaft causes the belt to move over the first and second shafts and thereby causes the medication items to move along the belt, which enables the medication items to be dispensed by the unit. The belt preferably has ridges or partitions or other article receiving compartments formed thereon to hold the medication items in the proper place so that they will not get mixed up with other medication items in the unit. These article

receiving compartments enable the system to accurately dispense one or more single units of medication items.

Another embodiment of a medication dispensing unit of the system includes a frame, a first shaft with first and second ends with each of the ends rotatably secured within the frame, and a second shaft with first and second ends with each of the ends rotatably secured within the frame. This medication dispensing unit also includes a first belt with first and second surfaces and the first belt passes over the first and second shafts near the first end of the first and second shafts. The medication dispensing unit also includes a second belt with first and second surfaces and the second belt passes over the first and second shafts near the second end of the first and second shafts. The unit further includes a plurality of dividers that are secured between the first belt and the second belt. A platform is also included that is positioned between the first shaft and the second shaft, and the platform forms a barrier so that the units of medication items will remain within the dividers. The modular medication dispensing unit includes a housing secured to the frame, the housing and the frame encloses all or part of the first and second belts, the first and second shafts, the plurality of dividers, and the platform, thereby forming compartments to hold units of medication items between the platform, the dividers, the housing and the frame. The modular medication dispensing unit includes a motor that is operatively connected to at least one of the shafts to rotate the shaft along its axis which causes the belts to move over and around the first shaft and the second shaft, thereby causing the compartments to move within the unit which enables the dispensing of the medication items loaded in the compartments of the unit.

The modular medication dispensing units may include an microprocessor in each of the units. The microprocessor is operatively connected to the motor and to the CPU of the

system. The microprocessor is capable of storing data, even when powered off. This data may include the quantity, type, expiration dates, lot numbers, drug code numbers and other information about the medication item that is contained in the unit. The microprocessor stores all of this information and retains this information even when the modular medication dispensing unit is moved to another system.

The CPU in the system stores and updates information about the medication items in the drawers, compartments and/or dispensing units. This information may include the quantity, type, expiration dates, lot numbers, drug code numbers, and various other information that is applicable to the medication items in the system. The CPU also enables this information to be displayed to an authorized user of the system. The CPU sends and receives signals to and from the microprocessors for the drawers, compartments and/or dispensing units to facilitate the progress and regress of medication items for loading and unloading the system.

The modular medication dispensing unit may further include sensors to detect when a medication item is inserted into the unit, sensors to detect when a medication item is dispensed by the unit, and sensors to detect when a compartment of the unit has a medication item therein. The sensors are connected to the microprocessor to record the information detected by the sensors, including the number of medication items loaded in the units and the number of medication items dispensed from the units.

The dispensing units are capable of dispensing a plurality of unit drug doses and single units of medication items of various sizes, shapes and types. The medication items that can be dispensed by the system include, but are not limited to, syringes, ampules, vials, pills, capsules, supplies, pharmaceuticals and the like. The system includes a CPU of a computer

with a monitor that preferably has touch screen capability to enable the user to easily interact with the system. The CPU is capable of receiving and transmitting user information, patient information, medication information, and the like. The CPU can be used to transfer information to and from the microprocessors and can determine the inventory in the system at any given time. The system also has a printer to enable the user to print out hard copies of all transactions and records regarding the loading and dispensation of medication items.

The system may also have other features such as a magnetic card reader to allow only authorized users to use the system and an alarm when unauthorized users attempt to gain access to the system. The system may also give the user a message if a drug has been prescribed to a patient and the patient is allergic to that drug or, if two or more medications are prescribed to be given to the patient together and the patient has a history of allergic reactions to a combination of these medications. The patient's history is input into the system before any medication is dispensed to the patient.

The system may be portable/movable with lockable wheels or rollers connected to the bottom of the cabinet. This enables the user to keep the medication items near the patients.

Other objectives, advantages and novel features of the present invention will become apparent from the following detailed description of the invention and the accompanying drawings.

BRIEF DESCRIPTION OF THE DRAWINGS

Figure 1 is a front view of the medication administration system.

Figure 2 is a perspective view of an embodiment of a modular medication dispensing unit used in the present invention.

Figure 3 is a plan view of an example of a template that can be used as a top of the housing of a modular medication dispensing unit used in the present invention.

Figures 4A, 4B and 4C show a syringe, ampule and vial, respectively, on a shelf in accordance with the present invention.

Figure 5 shows a drawer having a solenoid latch mechanism with a spring in accordance with the present invention.

Figure 5A shows a drawer containing a modular unit-of-use medication dispensing unit in accordance with the present invention.

Figure 5B shows an enlarged view of a solenoid latch mechanism attached to a drawer in accordance with the present invention.

Figure 6 shows a perspective view of an embodiment of a modular medication dispensing unit in accordance with the present invention.

Figure 7 shows a view of the parts assembled in the modular medication dispensing unit shown in Figure 6.

Figure 8 shows a side view of the modular medication dispensing unit shown in Figure 6.

Figure 9 shows a side view of the modular medication dispensing unit shown in Figure 6 with a hinged door for drug retrieval.

Figure 10 shows a perspective view of a modular medication dispensing unit of the present invention.

Figure 11 shows a side view of the modular medication dispensing unit shown in Figure 10.

Figure 12 is a side view of a modular medication dispensing unit showing electrical components of the present invention.

Figures 13A, 13B and 13C illustrate the loading operation of a modular medication dispensing unit in accordance with the present invention.

Figures 14A, 14B and 14C illustrate the dispensing operation of a modular medication dispensing unit in accordance with the present invention.

Figure 15 shows the electrical interconnections of the present invention.

Figure 16 is a perspective view of the unit dose modular medication dispensing unit in accordance with the present invention.

Figures 17A-17C show views of items of the present invention.

DETAILED DESCRIPTION OF PREFERRED EMBODIMENT(S)

Referring to Figure 1, there is shown a front view of the medication administration system 21 in accordance with the present invention. The system includes a cabinet 22 with a plurality of drawers 23 and compartments 25. There is a compartment for a CPU/computer, a monitor 27, a keyboard 30, and a printer 32 attached to the CPU. The computer hardware may consist of hardware known in the art that has the capability of handling the amount of information that the system 21 requires. A 486 computer system with a 200 MHz hard drive is sufficient. A preferred embodiment may have a touch screen monitor 27 with icons for easy communication with a user of the system 21.

The system 21 may also have a magnetic card reader that allows access only to authorized users to protect the security of the medication items stored in and dispensed by the system 21. In many hospitals, the pharmacist, doctors and nurses have magnetic keycards

with a personal identification number (PIN). Thus, it is preferred that the system 21 accept the same magnetic keycards that these employees at the hospital already use. The system 21 has drawers 23 and compartments 25 into which a pharmacist may load and store modular medication dispensing units as shown in Figures 13A, 13B, 13C and 15. The compartments 25 may have trays that slide out on which the modular medication dispensing units 40, 80 and 90 can be loaded. The compartments 25 are preferably designed to hold a number of different types and sizes of the modular medication dispensing units 40, 80 and 90 which dispense differing sizes, types and shapes of medication items. The term "medication items" as used throughout this application is defined as the various drugs, pharmaceuticals, medicines, supplies, containers, and other types of items used in a medical environment. These medication items may also include syringes, ampules, vials, pills, capsules, ointments, salves, etc.

When the medication items are dispensed by the dispensing units 80 and 90 they fall, by gravity, into a catch tray 66. When the appropriate medication item has been dispensed by the system 21, the appropriate drawer or compartment automatically opens to allow the user to retrieve the medication for a patient. The appropriate drawer may only open far enough so that the user can get the dispensed item but cannot get access to the medication dispensing unit itself. Normally, class II products (the most strictly controlled substances) are dispensed in unit doses by the dispensing units 80 and 90. Other classes of medication can also be dispensed by the dispensing units 80 and 90 as well as being dispensed by one or more of the other drawers 23 or compartments 25 in the cabinet 22 which will open when the proper information has been entered into the CPU for a patient. The system 21 performs unit dose dispensing of medication units, which helps eliminate some of the potential for human error.

The cabinet 22 also may contain a number of compartments 25 that can be used as storage areas for such things as bandages, gauze, etc. The cabinet 22 may also contain at least one drawer 23 or compartment 25 for returning unused medication that has been dispensed by the system 21.

The CPU of the system 21 is programmed with many types of information, including user names, user passwords, patient names, patient room numbers, medication prescribed, medications to which the patient is allergic, patient's billing code and the like. All of this information is used to accurately dispense medication items to a large number of patients in a hospital environment. Under normal operation, a user enters his or her user identification, either by inserting a magnetic card into the magnetic card reader, typing the user's name into the CPU with the keyboard 30, or by entering the user's name into the CPU via a touch screen display. The CPU then asks for the user's password to be entered into the system 21 via the keyboard 30 or touch screen display.

Once a user has entered a proper identification and password, a list of patient names for the floor of the hospital to which that particular system 21 is dedicated is displayed on the computer monitor 27. This information may come from the Administration Discharge Transfer (ADT) and is programmed into the CPU. The user can choose the patient from the list who gets medication. This can be done either through the keyboard 30 or by touching the proper portions of the monitor if a touch screen display is used. If a patient is not listed, the nurse can manually input information about the patient into the system 21 if authorized by the proper person in charge of registration. After the user chooses the patient's name, the CPU verifies that the user wants to receive information about this patient. The CPU lists the

medications prescribed for this patient and/or lists the different types of medication items loaded into the system 21.

The CPU preferably includes the patient's history of any drug reactions or drug interactions. For example, if a patient is allergic to codeine, the system 21 will not allow codeine to be dispensed to the user for this patient. Also, if the patient has a history of a drug interaction problem (i.e., two or more drugs together give the patient an allergic reaction), the system 21 will not dispense these drugs together to the patient. If either a drug reaction or drug interaction is programmed into the system 21 for a particular patient, a signal or message will appear on the monitor alerting the user about the patient's allergic reaction or interaction.

The user then chooses the medications from the list for the particular patient. For example, a variety of medications may be dispensed such as a syringe of codeine, two vials, two Tylenol®, and an IV bag. The CPU then verifies that the user is done requesting medication items, dispenses the medication items into a catch tray 66, and the proper drawer or compartment opens with the proper amount of medication. In a preferred embodiment, only one drawer or compartment will open at a time. When a user requests multiple medication items in different drawers or compartments, one compartment or drawer will be open at a time and the other compartments or drawers will not open until the medication item is retrieved from the open drawer and the open drawer is closed. At that point, the next drawer or compartment opens so that the user can retrieve the medication item from that particular drawer or compartment.

A light 31 such as a light emitting diode (LED) is connected to each of the drawers and compartments and is illuminated by the system 21 when the drawer 23 or compartment 25 opens with the medication items requested. The illumination of the light 31 helps the user

to identify the location of the requested medication item by providing visual feedback. This is especially important when using the system 21 in darkened conditions, such as late night care, to distinguish the properly dispensed medication item from other medication items that look the same. The light is also illuminated when a modular medication dispensing unit is loaded. This also helps to insure that the medication items to be loaded are loaded in the proper drawer or compartment.

The drawers 23 are operatively connected to the CPU and a signal from the CPU or the microprocessor 70 of a medication dispensing unit in the drawer opens the proper drawer when the medication item to be dispensed. These drawers 23 are preferably locked with a spring loaded latch mechanism 50 so that the drawers 23 are normally in a locked position and open up when the spring loaded latch 50 is activated by the CPU or the microprocessor 70. The system 21 keeps track of all of the medication items dispensed and to whom, and by whom, the medication items were dispensed. The system 21 enters this information on the patient's bill and records, and prints out a report to be put with the patient's medical chart. The CPU also automatically updates the information about the inventory that is loaded in the system 21 at any given time. The system keeps a record of the user, the medication item dispensed, the date and time of request for dispensing the medication item, the patient's name, and other relevant information. Thus, there will be a record of all transactions involving the system 21. This eliminates much of the potential human error and dispenses medication items to patients more accurately and efficiently.

The system 21 is also capable of reverse-dispensing one or a plurality of single units of medication items of heterogeneous sizes and types in response to input information from the user. This may be necessary when a patient does not take the medication that has been

dispensed for that patient, for example, if the patient refuses to take the medication or the patient is sleeping. If this happens, the user must then input information into the CPU regarding what is being returned to the system 21 and related information. When this information is entered into the system 21, a return drawer or compartment opens and the user inserts the unused medication item into the return drawer and closes the drawer. The system 21 credits the patient's account for this unused medication item and keeps track of the inventory in the return drawer. The system 21 prints out a record of the unused medication item to be included in the patient's record/chart. This also allows for the safe disposal of unused medication items and the unused medication items can be used at a later time when a pharmacist empties the return drawer and returns the unused medication items back into inventory or into the medication dispensing units 40, 80 and 90. If the unused medication items are not the type that are strictly controlled, such as Pepto Bismal™, IV bags, gauze, etc., the appropriate drawer or compartment that holds these medications and/or supplies can be opened for the user to return the unused items to the proper drawer or compartment to be used at a later time.

The medication dispensing and storage system 21 uses a number of techniques to control the dispensing of medication items. Substances that require a high degree of physical control can be dispensed using the various types of unit-of-use medication dispensing units of the present invention. These dispensing units can accommodate the full range of manufacturers' pre-packaged and repackaged medication items including syringes, vials, ampules, oral solids, oral liquids, PCA syringes, IV's, IV sets, catheter sets and other items and supplies.

The system 21 uses a "free floating par" which can be set by the hospital. "Par" is a quantity that is determined by the hospital to be a critical amount of a medication item in the system 21. If the quantity of a medication item gets below par, the system 21 gives an indication to the system manager or other person in charge of the system 21 that the system 21 contains less than the predetermined critical quantity of the medication item. This feature helps to keep inventory down in the hospital environment because all of the systems 21 do not have to be over-stocked. The system 21 also allows the hospital to set a predetermined quantity that is a minimum number of medication items that will be tolerated in a system 21. Once the quantity of the medication items in a system 21 is below the minimum set by the hospital, the system 21 gives a message that tells the pharmacy that the system 21 needs additional medical items immediately.

The system 21 also allows the assignment of expiration dates to all of the medication items that are loaded into the system 21. The users can also set dates that are prior to the expiration dates of the medication items and the system will send signals to these users that some medication items are ready to expire within a certain period of time. This makes this medication dispensing feature more efficient because less medication items will expire before they can be used.

In an embodiment, a medication dispensing and storage system 21 comprises a cabinet 22 having a plurality of drawers 23 and compartments 25. The system 21 preferably includes a plurality of medication dispensing units 40, wherein the medication dispensing units include a housing 42 having a top, bottom, front, back, and two sides, with the top having an opening to allow medication items to be inserted therein by a pharmacist.

The top of the housing 42 may include a template such as the one shown in Figure 3 that is shaped like the outline of the medication item to be inserted into the particular medication dispensing unit 40. This enables the pharmacist who is loading the medication dispensing unit 40 to know what size and orientation of medication items are to be loaded into that particular medication dispensing unit 40. The bottom of the housing 42 may have an opening or may include a door controlled by a solenoid to open when a medication item in the dispensing unit 40 is to be dispensed. The solenoid is activated by a signal from the microprocessor or the CPU and opens the door at the bottom of the housing 42 and the medication item drops through the door and is dispensed. There may be one or more dispensing drawers in which the dispensed medication item(s) falls to be retrieved by a user of the system 21.

The dispensing unit 40 also includes a first shaft 45 with each end rotatably secured within the housing 42, such that the first shaft 45 can easily rotate along its axes. The dispensing unit 40 also includes a second shaft 46 with each end rotatably secured within the housing 42, such that it can easily be rotated along its axes. The medication dispensing unit 40 further includes a plurality of shelves 33 arranged along a conveyor-type continuous loop, the loop passing over such first and second shafts 45 and 46. The plurality of shelves 33 are connected together to form a loop and move when the second shaft 46 is driven by a motor 48. The motor 48 is operatively connected to the second shaft 46 to rotate the second shaft 46 along its axis. This rotation of the second shaft 46 causes the plurality of shelves 33 to pass over the first and second shafts 45 and 46 and move the shelves inside the housing 42. The motor 48 may be a stepper motor, an actuator or other device that can rotate the shaft(s) 45 and/or 46.

The system 21 includes a microprocessor connected to the motor 48 and starts and stops the motor 48 via electronic signals through electrical wiring and connections known in the art. The microprocessor or CPU is also operatively connected to a latch mechanism for each of the drawers. The latch mechanism opens the respective drawers when medication is dispensed to allow a user to retrieve the appropriate medication for a patient.

In a preferred embodiment, the dispensing unit 40 further comprises at least one sensor 40 to detect when a medication item is inserted into the dispensing unit 40. The sensor 40 can be any sensor as known in the art for detecting whether an item is near the sensor 40 or not, such as a light source for producing a light beam and a photodiode responsive to the light beam. The sensor 40 may include infrared technology to sense when a medication item is inserted in the dispensing unit 40. Other types of sensors known in the art can be used as well.

The dispensing unit 40 may also include another sensor to detect when a medication item is dispensed by the dispensing unit 40. This sensor 42 is located near the bottom of the dispensing unit 40 to detect when a medication item is dispensed from the dispensing unit 40 into the dispensing drawer 13. This sensor 42 may be an infrared type sensor or any other sensor known in the art. The dispensing unit 40 may also include another sensor 44 to detect when a shelf of the dispensing unit 40 has a medication item thereon. This sensor 44 is preferably located near the top of the dispensing unit 40 so that the plurality of shelves 33 will stop when the shelf is empty so that the pharmacist can load the shelf 33 with a medication item. If the shelf 33 already has a medication item thereon, the shelf 33 will continue to go around until an empty shelf 33 is positioned at the top of the dispensing unit 40 so that the pharmacist loading the dispensing unit 40 can insert a medication item onto the

empty shelf 33. Again, all these sensors can be infrared or other types of sensors known in the art. All of these sensors are electrically connected to the microprocessor which records the information detected by the sensors. This information can be used to automatically inventory the medication items in the system 21 as well as to properly bill the patient for medication dispensed to the patient.

The medication dispensing unit 40 are of various sizes to be capable of dispensing the plurality of unit drug doses in medication items of heterogeneous sizes, shapes, and types. The cabinet 22 of the system 21 is designed to hold a number of dispensing units 40 that are of different sizes and capable of dispensing a large variety of different medications in unit drug doses. The medication items that can be dispensed by the system 21 includes syringes, ampules, vials, pills, capsules, and other medications and/or supplies.

The first and second shafts 45 and 46 of the dispensing unit 40 may have a plurality of "teeth" which engage the conveyor-type loop of shelves 33 to advance the shelves 33. The conveyor-type continuous loop of a plurality of shelves 33 may be formed a single unitary belt with article receiving compartments, pockets or shelves thereon. The loop may be formed by connecting the shelves 33 with string, plastic cord, wire, or other connecting material. The string, plastic cord, wire or other connecting material may be a continuous loop threaded through the plurality of shelves 33 or it may be single pieces between each plurality of shelves 33. The shelves 33 may be made of plastics, metal or other rigid material. The housing 42 of the dispensing unit 40 is preferably made of plexiglass, which enables a pharmacist to do a visual inspection of the medication dispensing units as well as to visually do an inventory of the medication items in the dispensing units 40.

The cabinet 22 may be portable/movable with wheels, rollers or other rolling means connected to the bottom of the cabinet 22 so that the user can easily move the system 21 to different areas of the hospital. The cabinet 22 also includes at least one drawer that is used for returning unused medication. This drawer is open by the microprocessor when the user has indicated that medication is to be returned and gives the type and amount of the medication. This return drawer may be designed such that only items can be inserted therein and items contained within the drawer cannot be removed, except by pharmacist or other authorized personnel. The cabinet 22 also contains other drawers or compartments to store equipment that is not in the medication dispensing units 40, such as IV bags, gauze, bandages, etc.

The microprocessor 70 of the respective modular medication dispensing units may be on a board with circuitry to drive the solenoid latch mechanism 50, the LEDs 31 and the various sensors 35. The preferred component of the microprocessor 70 is a PIC16C84 micro controller. The microprocessor 70 is capable of storing data, even when powered off. This storage capability is used by the system 21 to know the quantity, position and type of medication items contained in the dispensing unit 40. The microprocessor 70 stores all of this information which allows a user to move the dispensing unit 40 from one system 21 to another, and the microprocessor will retain all of the relevant information about the medication items in its corresponding dispensing unit 40.

The link between the dispensing unit 40 and the CPU is a serial line. The CPU sends command messages to the microprocessor 70 and the microprocessor 70 carries out the tasks requested and replies back to the CPU. The CPU of the CPU is also used for communication with the user, any connected servers, record keeping and interface displays.

Figures 5A and 5B show a drawer 23 containing another embodiment of unit-of-use medication dispensing units 80 or 90. This embodiment of the modular medication dispensing unit 80 or 90 includes a conveyor belt type of assembly and the modular medication dispensing unit 80 or 90 is connected to a card edge connector 38 that is connected to the microprocessor 70 and then to the CPU. The drawer 23 for this embodiment also includes a solenoid latch mechanism 50. The solenoid latch mechanism 50 is shown in some detail and includes a spring, latch and a solenoid that is electrically connected to the microprocessor 70 and the CPU. The spring is biased to open the drawer 23 but the latch keeps the drawer closed until the solenoid is activated. When the solenoid is activated, the latch releases and the spring pushes the drawer 23 open so that the user can retrieve the dispensed medication item.

Another preferred embodiment of a modular medication dispensing unit 80 is shown in Figures 6, 7 and 8. This dispensing unit 80 includes a frame 58, a first shaft 45 that is rotatably secured within the frame 58 and a second shaft 46 that is rotatably secured within the frame 58. This unit 40 may also include cylinders 55 around the first and second shafts 45 and 46 that rotate around the same axis as the shafts 45 and 46. The cylinders 55 rotate with the corresponding shaft. A belt 60, which forms a loop, passes over and around the first and second shafts 45 and 46 and cylinders 55. The shafts and cylinders are rotated about their axis and this makes the belt 60 move over and around the cylinders 55. The belt 60 is like a conveyor belt. A housing 42 is secured to the frame 58 and the housing 42 and frame 58 substantially enclose all or part the belt 60, the first and second shafts 45 and 46, and cylinders 55 in a manner such that the medication items that the user has loaded on the belt 60 will not fall out of the unit 80 unless they are to be dispensed.

The housing 42 and the frame 55 are placed close enough to the belt 60 on the side, above the belt 60 and around the belt 60 such that compartments are formed where medication items can be loaded and stored until they are dispensed. In a preferred embodiment, the belt 60 is integrally formed of polyurethane as a continuous piece of material and includes integrally formed article receiving compartments, ridges or partitions on the outside surface of the belt 60 which enable medication items to be kept separate and unit dose dispensed. Other materials can be used to form the belt 60 and these materials should be flexible yet sturdy. A motor 48 is operatively connected to the shaft and rotates the shaft along its axis, thereby rotating the cylinders 55 and moving the belt 60 and the medication items on the belt.

The housing 42 includes an opening to allow medication items to be loaded by a user and another opening that allows the medication items to be dispensed from the unit 80. These openings in the housing 42 may have a hinged door or other means that can be opened and closed in order to load and/or dispense medication items therefrom. In another embodiment, the belt 60 may also have gear-shaped ridges or grooves on the opposite surface than the ridges or partitions that hold the medication items. These gear-shaped ridges or grooves on the belt 60 fit within gears formed on the outside of the cylinders 55 or shafts 45 and 46. The use of the gears on the cylinders 55 is a preferred embodiment because it helps eliminate slipping of the belt and enables the unit to have better control over the distance that the belt 60 is advanced in order to dispense a single medication unit in an accurate manner.

In another embodiment, the belt 60 may have apertures therethrough that hold a plurality of dividers that are arranged along the belt 60. In this embodiment, the dividers could be inserted in or on the belt 60 to form compartments to hold the medication items

loaded in the unit 80. This unit 80 may also include a light 31, such as an LED, to indicate when the unit 80 is activated to be loaded or to have a medication item dispensed therefrom.

In Figure 9, the belt-type modular medication dispensing unit 80 is shown in conjunction with a catch tray 66 into which the dispensed medication items are dropped. In order for the user to retrieve the dispensed medication item, a hinged door 64 may be provided. The light 31 is illuminated when a medication item is dispensed into the catch tray 66 to visually show the user which drawer 23 and which door 64 from which the user can retrieve the dispensed medication item. The user reaches into the catch tray 66 by swinging the hinged door 64 back and removes the dispensed medication item.

Another embodiment of a belt-type modular medication dispensing unit 90 is shown in Figures 10 and 11. In this embodiment, there are two belts 62 and the medication items do not sit on the belts 62. In this embodiment, the modular medication dispensing unit 90 includes a frame 48, a first and second shaft 45 and 46 that are rotatably secured within the frame 48. In unit 90, each shaft 45 and 46 includes two cylinders 55 near the ends of the shafts 45 and 46. These cylinders 55 rotate with the shafts 45 and 46. There are two belts 62 that pass over and around the cylinders 55 when the shafts 45 and 46 and the cylinders 55 are rotated about their axis. The belts 62 are near the opposing sides of the unit 90. A plurality of dividers that are substantially perpendicular to the belts 62 are provided. The dividers extend between the belts 62 and are spaced apart from each other. This spacing must be large enough to hold the medication items to be stored and dispensed. There may be apertures or notches in the side of each of the belts 62 in which the ends of the dividers may be secured. The ends of the dividers may be secured to the belt 62 by glue or other suitable means.

Unit 90 also includes a platform 59 that is positioned between the shafts 45 and 46, the cylinders 55 and the frame 48. The platform 59 forms a barrier so that the medication items remain within the dividers. Unit 90 also includes a housing 42 that is secured to the frame 48. The housing 42 and the frame 48 substantially enclose all or part of the first and second belts 60, the first and second shafts, the plurality of dividers, and the platform 59, thereby forming compartments to hold medication items. The compartments are formed between the platform 59, the dividers, the housing 42 and the frame 48. When the belts 62 and the dividers move along the platform 59 and over and around the cylinders 55, the medication items are also moved within the compartments and are dispensed once they reach the opening near the bottom of the housing 42. A motor 48 is operatively connected to at least one of the shafts 45 or 46 to rotate the shaft along its axis, thereby causing the belts 62 and the dividers to move within the unit 90.

In another embodiment, the cylinders 55 may be a cam wheel 72 that has gears that match gear grooves in the belts 62 to accurately move the belts 62 around the cam wheels 72. Unit 90 may also have a light 31, such as a LED, to indicate which unit 90 is activated to be loaded or to have a medication item dispensed therefrom. Unit 90 is also connected to a microprocessor 70 that is connected to the CPU. The microprocessor 70 and the CPU keep track of all of the types and quantities of medication items loaded in unit 90 and dispensed therefrom.

Modular medication dispensing unit 80 or 90 may also include various sensors that detect placement and/or the dispensing of a medication item into a catch tray 66 from which the user can retrieve the dispensed medication item. The width of the platform 59 and the unit 90 can be varied to fit various sizes of medication items. In a preferred embodiment, unit

90 is placed within a drawer 23 or compartment 25 of the system 21. Unit 90 is modular and can be moved to another system while the microprocessor 70 retains the relevant information regarding the medication items in the unit 90.

In Figure 12, the electrical components of the belt-type of modular medication dispensing units 80 and 90 are shown. The motor 48 rotates the shafts 45 and 46, which also rotates the cam wheels 72 or cylinders 55 to move the belt 60 or 62 in the unit 80 or 90. The microprocessor 70 is connected to the system 21 via a card edge connector 38. The connector 38 supplies power to the modular medication dispensing unit 80 or 90 and provides a serial interface with the CPU. An index switch 74 may also be included with the cam wheel 72 to sense the position of the belt 60 or 62. The index switch 74 can sense the position of the belt 60 or 62 in a number of manners as is known in the art. The microprocessor 70 also controls, via the card edge connector 38, the solenoid lock mechanism 50 for the drawer 23 in for which the modular medication dispensing unit 80 or 90 is contained. The microprocessor 70 also senses that the drawer 23 is closed and illuminates the drawer LED 31 when the drawer 23 is opened.

The present invention may also include the microprocessor 70 dedicated to various types of medication dispensing units within a system 21. An example of another type of medication dispensing unit is a drawer containing medication items to be dispensed. There are other medication dispensing units known in the art and the present invention of a dedicated microprocessor corresponding to each medication dispensing system in a system is also a part of the present invention. In accordance with the present invention, the microprocessor is connected to the motor of the modular medication dispensing unit to enable the modular medication dispensing unit to be loaded in a controlled manner, and to enable the

modular medication dispensing unit to dispense unit doses of medication in a controlled manner for a particular patient, the first programmable processor being capable of receiving and storing information about the respective type, quantity and medication information of each of the unit doses of medication loaded onto an assigned shelf of the modular medication dispensing unit, the information in the first programmable processor being automatically updated when a unit dose of medication is dispensed from the modular medication dispensing unit, and the first programmable processor containing information about the remaining inventory in the modular medication dispensing unit at any given time.

Figures 13A, 13B and 13C illustrate the loading operation of the belt-type modular medication dispensing unit 80. The loading operation begins with an authorized user indicating a loading operation on the CPU. After the request, the drawer 23 or compartment 25 containing the modular medication dispensing unit 80 to be loaded opens via the solenoid latch mechanism 50. As the drawer 23 opens, the unit 80 to be loaded illuminates its LED 31 so that it is obvious to the user which unit 80 to load. The unit 80 backs up its belt 60 so that the new medication items can be loaded directly behind the medication items currently in the unit 80. Figure 13A illustrates the loading of ten medication items. After the ten medication items are loaded, the user indicates "MORE" on the CPU and the belt 60 advances to load additional medication items. In Figure 13C, two more medication items are loaded. When the user is done loading, he or she indicates "DONE" on the CPU and the user interface asks the user how many medication items were loaded on the last set (in this case, two). The interface may display a picture of what the dispensing unit 80 should currently look like (from a top view) and ask the user to confirm. Once the user has confirmed the correct

loading of the medication items, the loading is done. The user is then requested to close the drawer 23 or compartment 25 to complete the loading operation.

Figures 14A, 14B and 14C illustrate the dispensing of medication items. When a medication item is dispensed, the belt 60 first advances the medication items to the opening near the front and bottom of the modular medication dispensing unit 80. (This is only necessary after a loading operation.) After the medication items are in position, the belt 60 indexes ahead one position for each medication item requested. In Figure 14B, one medication item is dispensed. The medication item falls into a catch tray 66 and the user retrieves the medication item through the hinged door 64. Each drawer 23 preferably has a catch tray 66 and a hinged door 64; this increases the flexibility and interchangability of the system 21. The drawer 23 of the system 21 can include multiple modular medication dispensing units 80 and 90, as shown in Figure 15.

The housing 42 may include a template such as the one shown in Figure 16 that is shaped like the outline of the medication item to be inserted into the particular modular medication dispensing unit 80 or 90. This enables the pharmacist or person who is loading the unit 80 or 90 to know the size and orientation of medication items that are to be loaded into that particular unit 80 or 90.

In a preferred embodiment, the dispensing unit 80 or 90 further comprises at least one sensor 49 to detect when a medication item is inserted into the dispensing unit 80 or 90. The sensor 49 can be any sensor as known in the art for detecting whether an item is near the sensor 49, such as a light source for producing a light beam and a photodiode responsive to the light beam. The sensor 49 may include infrared technology to sense when a medication

item is inserted in the dispensing unit 80 or 90. Other types of sensors known in the art can be used as well.

The dispensing unit 80 or 90 may also include another sensor to detect when a medication item is dispensed by the dispensing unit 80 or 90. This sensor 52 is located near the bottom of the dispensing unit 80 or 90 to detect when a medication item is dispensed from the dispensing unit 80 or 90 into the catch tray 66. This sensor 49 may be an infrared type sensor or any other suitable sensor known in the art. The dispensing unit 80 or 90 may also include other sensors 54 to detect when a compartment of the dispensing unit 80 or 90 has a medication item thereon. These sensors 54 are preferably located around the frame 58 of the dispensing unit 80 or 90. All of these sensors are electrically connected to the CPU which records the information detected by the sensors. This information can be used to automatically inventory the medication items in the system 21 as well as to properly bill the patient for medication items dispensed to the patient.

The housing 42 and frame 58 of the dispensing unit 80 and 90 is preferably made of plexiglass or acrylic, which enables a pharmacist to do a visual inspection of the dispensing units 80 and 90 as well as to visually do an inventory of the medication items in the dispensing units 80 and 90.

The system 21 will preferably have a STAT function that allows immediate access to an emergency box of medication items when there is an emergency. The user has the option of opening drawer 23 or compartment 25 that contains the emergency box of medication items without logging into the CPU of the system 21. The user can bypass the normal security of the system 21 and get access to this emergency box of mediation items. The CPU keeps a record that the STAT function was used and when the emergency is over, the user

must enter information into the CPU about the medication items used from the emergency box and the patient information. The CPU then sends a signal to the pharmacy as to what the emergency STAT box needs (what medication items were used from the emergency box).

The system 21 may also include a solid state refrigerated drawer. This refrigerated drawer may be used for narcotics and other class II drugs. This solid state refrigerated drawer includes a sensor that senses the temperature levels and an alarm will go off when the temperature inside the refrigerated drawer gets below a predetermined temperature. The medication dispensing units 40 will fit within the refrigerated drawers and operate like the other drawers discussed herein.

The above-described preferred embodiment of the present invention should not be construed as limiting the scope of the following claims. The invention has been described in detail to provide a thorough description of the capabilities and options of the method of the invention. One skilled in the art could readily add to or subtract from various options described herein without departing from the spirit and scope of the invention.

What is claimed is:

1. A medication dispensing and storing medication dispensing unit to be used in a medication administration system, to store and dispense unit doses of medication in a highly controlled manner without allowing a user of the medication dispensing unit to dispense more medication than requested without having the inventory automatically updated, said medication dispensing unit comprising:

a housing having a top, bottom, front, back, and two sides, said top having an opening to allow medication items to be inserted therein and said bottom having an opening to allow medication items to be dispensed therefrom;

a first shaft having first and second ends with each of said ends of said first shaft rotatably secured within said housing;

a second shaft having first and second ends with each of said ends of said second shaft rotatably secured within said housing;

a plurality of shelves arranged along a conveyor-type continuous loop, said loop passing over said first and second shafts;

a motor operatively connected to one of said shafts to rotate one of said shafts along its axis, the rotation of said shaft causing the plurality of shelves to move along said loop; and

a first programmable processor connected to said motor of said medication dispensing unit to enable said medication dispensing unit to be loaded in a controlled manner, and to enable said medication dispensing unit to dispense unit doses of medication in a controlled manner for a particular patient, said first programmable processor being capable of receiving and storing information about the respective

type, quantity and medication information of each of the unit doses of medication loaded onto an assigned shelf of said medication dispensing unit, the information in said first programmable processor being automatically updated when a unit dose of medication is dispensed from said medication dispensing unit, and said first programmable processor containing information about the remaining inventory in said medication dispensing unit at any given time.

2. The medication dispensing unit of claim 1 further comprising at least one sensor to detect when a medication item is inserted therein.

3. The medication dispensing unit of claim 1 further comprising at least one sensor to detect when a medication item is dispensed therefrom.

4. The medication dispensing unit of claim 1 further comprising at least one sensor to detect when a shelf of said dispensing unit has a medication item thereon.

5. The medication dispensing unit of claim 1 further comprising first sensors to detect when a medication item is inserted therein, second sensors to detect when a medication item is dispensed therefrom, and third sensors to detect when a shelf of said dispensing unit has a medication item thereon, and all of said sensors being connected to said first programmable processor to record the information detected by said first, second and third sensors.

6. The medication dispensing unit of claim 1 wherein said shelves enable said medication dispensing unit to store and dispense a plurality of unit drug doses in medication items of heterogeneous sizes, shapes and types.

7. The medication dispensing unit of claim 1 wherein the medication items stored and dispensed include one of the group consisting of syringes containing a dose of medicine, ampules containing a dose of medicine, and vials containing a dose of medicine.

8. The medication dispensing unit of claim 1 wherein the top of said housing defines a template with an opening shaped like the medication item to be inserted therein.

9. The medication dispensing unit of claim 1 wherein the bottom of said housing includes a door actuated by a solenoid to open the door to dispense a medication item, said solenoid being connected to said first programmable processor.

10. The system of claim 1 wherein said housing is made of plexiglass to enable an individual to perform a visual inspection of said medication dispensing unit and to perform a visual inventory of the medication items in said medication dispensing unit.

11. A medication administration system comprising:

a cabinet having a plurality of drawers and compartments;

at least one medication dispensing unit located in at least one of the compartments or drawers, said dispensing unit being modular and removable from said system, said medication dispensing unit comprising:

a housing having a top, bottom, front, back, and two sides, said top having an opening to allow medication items to be inserted therein and said bottom having an opening to allow medication items to be dispensed therefrom;

a first shaft having first and second ends with each of said ends of said first shaft rotatably secured within said housing;

a second shaft having first and second ends with each of said ends of said second shaft rotatably secured within said housing;

a plurality of shelves arranged along a conveyor-type continuous loop, said loop passing over said first and second shafts; a motor operatively connected to one of said shafts to rotate one of said shafts along its axis, the rotation of said shaft causing the plurality of shelves to move along said loop; and

a first programmable processor connected to said motor of said medication dispensing unit to enable said medication dispensing unit to be loaded in a controlled manner, and to enable said medication dispensing unit to dispense unit doses of medication in a controlled manner for a particular patient, said first programmable processor being capable of receiving and storing information about the respective type, quantity and medication information of each of the unit doses of

medication loaded onto an assigned shelf of said medication dispensing unit, the information in said first programmable processor being automatically updated when a unit dose of medication is dispensed from said medication dispensing unit, and said first programmable processor containing information about the remaining inventory in said medication dispensing unit at any given time; and a second programmable processor in said cabinet, said second programmable processor being operatively connected to said first programmable processor and to at least one of said drawers or compartments.

12. The system of claim 11 wherein said medication dispensing unit further comprises at least one sensor to detect when a medication item is inserted into said medication dispensing unit.

13. The system of claim 11 wherein said medication dispensing unit further comprises at least one sensor to detect when a medication item is dispensed from said medication dispensing unit.

14. The system of claim 11 wherein said second programmable processor is capable of receiving input of user information, patient information and medication information, said second programmable processor being operatively connected to said first programmable processor to enable the first and second programmable processors to transfer information to and from each other regarding the respective type, quantity and medication

information of each of the unit doses of medication loaded into said medication dispensing unit and dispensed from said medication dispensing unit.

15. The system of claim 14 wherein said second programmable processor uses information from the first programmable processor of each of said dispensing units regarding the respective type, quantity and medication information of each of the unit doses of medication loaded into said medication dispensing units and dispensed from said medication dispensing units to determine the remaining inventory in said medication dispensing units and, thus, said system at any given time.

16. The system of claim 11 further comprising a keyboard, touch screen or other input device connectable to said second programmable processor to enable a user to input information.

17. The system of claim 11 further comprising a latch mechanism for each of said drawers, wherein said latch mechanism includes a spring, said latch mechanism locks the drawers when the drawers are closed and opens the proper drawers by use of the spring when signalled by said second programmable processor to dispense medication.

18. The system of claim 11 wherein said cabinet is portable with rolling means connected to the bottom of said cabinet.

19. The medication dispensing unit of claim 11 wherein said medication dispensing unit further comprises first sensors to detect when a medication item is inserted therein, second sensors to detect when a medication item is dispensed therefrom, and third sensors to detect when a shelf of said dispensing unit has a medication item thereon, and all of said sensors being connected to said first programmable processor to record the information detected by said first, second and third sensors.

20. The medication dispensing unit of Claim 11 wherein the bottom of said housing includes a door actuated by a solenoid to open the door to dispense a medication item, said solenoid being connected to said first programmable processor.

21. A medication administration system comprising:
a cabinet having a plurality of drawers and compartments;
at least one medication dispensing unit located in at least one of the compartments,
said dispensing unit including:
a programmable processor connected to said medication dispensing
unit to dispense medication for a particular patient;
a housing having a top, bottom, front, back, and two sides, said top
having an opening to allow medication items to be inserted therein, said
bottom including a door actuated by a solenoid to open the door to dispense a
medication item, said solenoid being connected to said programmable
processor;

a first shaft having first and second ends with each of said ends of said first shaft rotatably secured within said housing;

a second shaft having first and second ends with each of said ends of said second shaft rotatably secured within said housing;

a plurality of shelves arranged along a conveyor-type continuous loop, said loop passing over said first and second shafts; and

a motor operatively connected to one of said shafts to rotate one of said shafts along its axis, the rotation of said shaft causing the plurality of shelves to move along said loop.

22. A medication dispensing unit comprising:

a programmable processor connected to said medication dispensing unit to dispense medication for a particular patient;

a housing having a top, bottom, front, back, and two sides, said top having an opening to allow medication items to be inserted therein, said bottom including a door actuated by a solenoid to open the door to dispense a medication item, said solenoid being connected to said programmable processor;

a first shaft having first and second ends with each of said ends of said first shaft rotatably secured within said housing;

a second shaft having first and second ends with each of said ends of said second shaft rotatably secured within said housing;

a plurality of shelves arranged along a conveyor-type continuous loop, said loop passing over said first and second shafts; and

a motor operatively connected to one of said shafts to rotate one of said shafts along its axis, the rotation of said shaft causing the plurality of shelves to move along said loop.

23. A medication dispensing unit for dispensing one or more single units of medication items comprising:

a frame;

a first shaft having first and second ends with each of said ends of said first shaft rotatably secured within said frame;

a second shaft having first and second ends with each of said ends of said second shaft rotatably secured within said frame;

at least one belt having first and second surfaces, said belt passing over and around said first and second shafts;

a housing secured to said frame, said housing, in conjunction with said frame, enclosing all or part of said belt, first shaft and second shaft, such that the medication items will not fall out of said unit until the medication items are dispensed from said unit;

a motor operatively connected to at least one of said shafts to rotate said shaft along its axis, the rotation of said shaft causing the belt to move over and around the first shaft and the second shaft; and

a microprocessor connected to said motor of said medication dispensing unit to enable said medication dispensing unit to be loaded in a controlled manner, and to enable said medication dispensing unit to dispense unit doses of medication in a controlled manner for a particular patient, said microprocessor being capable of receiving and storing information about the type and quantity of the unit doses of medication loaded into said medication dispensing unit, the information in said microprocessor being automatically updated when a unit dose of medication is dispensed from said medication dispensing unit, and said microprocessor containing information about the inventory in said medication dispensing unit at any given time.

24. The unit of claim 23 further comprising a first cylinder around said first shaft and a second cylinder around said second shaft, said first and second cylinders each having first and second ends, said first cylinder having the same axis of rotation as said first shaft and said second cylinder having the same axis of rotation as said second shaft, said belt passing over and around said first and second cylinders.

25. The unit of claim 23 wherein the first surface of said belt has integrally formed article receiving compartments to hold medication items.

26. The unit of claim 23 wherein said belt has apertures therethrough to hold a plurality of dividers arranged along said belt.

27. The unit of claim 23 wherein said housing includes an opening to allow medication items to be inserted therein and an opening to allow medication items to be dispensed therefrom.

28. The unit of claim 23 wherein the opening to allow medication items to be dispensed from said unit includes a door connected to a solenoid to open the door to dispense a medication item.

29. The unit of claim 23 wherein the second surface of said belt has integrally formed notches to engage said first shaft and said second shaft.

30. The unit of claim 24 wherein said first cylinder and second cylinder have gears to engage said belt.

31. The system of claim 23 wherein said microprocessor is connected to said CPU via a card edge connector, said card edge connector supplying power to said microprocessor and providing a serial interface from said microprocessor to said CPU.

32. The unit of claim 23 further including a light attached to said unit to indicate when said unit is activated to be loaded or to have a medication item dispensed therefrom.

33. The unit of claim 23 further comprising at least one sensor to detect when a medication item is inserted therein, said sensor being connected to said microprocessor to record the information detected by said sensor.

34. The unit of claim 23 further comprising at least one sensor to detect when a medication item is dispensed therefrom, said sensor being connected to said microprocessor to record the information detected by said sensor.

35. A medication dispensing unit for dispensing one or more single units of medication items comprising:

a frame;

a first shaft having first and second ends with each of said ends of said first shaft rotatably secured within said frame;

a second shaft having first and second ends with each of said ends of said second shaft rotatably secured within said frame;

a first belt having first and second surfaces, said first belt passing over and around said first and second shafts near the first end of said first and second shafts;

a second belt having first and second surfaces, said second belt passing over and around said first and second shafts near the second end of said first and second shafts;

a plurality of dividers, each having a first and second end, said first end of each of said dividers being secured to said first belt and said second end of each of said dividers being secured to said second belt;

a platform being connected to said frame, said platform being positioned between said first shaft and said second shaft, said platform forming a barrier so that the units of medication items stay within said dividers;

a housing secured to said frame, said housing, in conjunction with said frame, enclosing all or part of said first and second belts, said first and second shafts, said plurality of dividers, and said platform, whereby compartments to hold medication items are formed between said platform, said dividers, said housing and said frame,

such that the medication items will not fall out of said unit until the medication items are dispensed from said unit;

a motor operatively connected to at least one of said shafts to rotate said shaft along its axis, the rotation of said shaft causing said belts to move over and around the first shaft and the second shaft, thereby causing the compartments to move within said unit; and

a microprocessor connected to said motor of said medication dispensing unit to enable said medication dispensing unit to be loaded in a controlled manner, and to enable said medication dispensing unit to dispense unit doses of medication in a controlled manner for a particular patient, said microprocessor being capable of receiving and storing information about the type and quantity of the unit doses of medication loaded into said medication dispensing unit, the information in said microprocessor being automatically updated when a unit dose of medication is dispensed from said medication dispensing unit, and said microprocessor containing information about the inventory in said medication dispensing unit at any given time.

36. The unit of claim 35 further comprising a first cylinder around said first shaft and a second cylinder around said second shaft, said first and second cylinders each having first and second ends, said first cylinder having the same axis of rotation as said first shaft and said second cylinder having the same axis of rotation as said second shaft, said first belt passing over and around said first and second cylinders near the first end of said first and second cylinders, and said second belt passing over and around said first and second cylinders near the second end of said first and second cylinders.

37. The unit of claim 35 wherein said motor is operatively connected to at least one of said shafts by a cam wheel.

38. The unit of claim 35 wherein said first and second belts have apertures therethrough and said dividers have extensions extending from the first and second ends of

said dividers, said dividers being securable to said first and second belts by inserting the extensions of said dividers into the apertures of said first and second belts.

39. The unit of claim 35 wherein said housing comprises an opening to allow medication items to be inserted therein and an opening to allow medication items to be dispensed therefrom.

40. The unit of claim 65 wherein the opening to allow medication items to be dispensed from said unit includes a door connected to a solenoid to open the door to dispense a medication item.

41. The unit of claim 35 wherein said first shaft and second shaft have gears to engage said belts.

42. The unit of claim 36 wherein said first cylinder and second cylinder have gears to engage said belts.

43. The system of claim 35 wherein said microprocessor is connected to said CPU via a card edge connector, said card edge connector supplying power to said microprocessor and providing a serial interface from said microprocessor to said CPU.

44. The unit of claim 35 further including a light attached to said unit to indicate when said unit is activated to be loaded or to have a medication item dispensed therefrom.

45. A medication administration system comprising:
- a cabinet having a plurality of drawers and compartments;
 - at least one medication dispensing unit located in at least one of the drawers or compartments, said medication dispensing unit comprising:
 - a frame;
 - a first shaft having first and second ends with each of said ends of said first shaft rotatably secured within said frame;
 - a second shaft having first and second ends with each of said ends of said second shaft rotatably secured within said frame;
 - at least one belt having first and second surfaces, said belt passing over and around said first and second shafts;
 - a housing secured to said frame, said housing, in conjunction with said frame, enclosing all or part of said belt, first shaft and second shaft, such that the medication items will not fall out of said unit until the medication items are dispensed from said unit;
 - a motor operatively connected to at least one of said shafts to rotate said shaft along its axis, the rotation of said shaft causing the belt to move over and around the first shaft and the second shaft; and
 - a microprocessor connected to said motor of said medication dispensing unit to enable said medication dispensing unit to be loaded in a controlled manner, and to enable said medication dispensing unit to dispense unit doses of medication in a controlled manner for a particular patient, said microprocessor being capable of receiving and storing information about the type and quantity of the unit doses of medication loaded into said medication dispensing unit, the information in said microprocessor being automatically updated when a unit dose of medication is dispensed from said medication dispensing unit, and said microprocessor containing information about the inventory in said medication dispensing unit at any given time; and
 - a CPU operatively connected to said microprocessor to communicate information about the medication items loaded and dispensed.

46. The system of claim 45 wherein said medication dispensing unit further comprises a first cylinder around said first shaft and a second cylinder around said second shaft, said first and second cylinders each having first and second ends, said first cylinder having the same axis of rotation as said first shaft and said second cylinder having the same axis of rotation as said second shaft, said belt passing over and around said first and second cylinders.

47. The system of claim 45 wherein the first surface of said belt of said medication dispensing unit has integrally formed article receiving compartments or shelves to hold medication items.

48. The system of claim 45 wherein said belt of said medication dispensing unit has apertures therethrough to hold a plurality of dividers arranged along said belt.

49. The system of claim 45 wherein said housing of said medication dispensing unit includes an opening to allow medication items to be inserted therein and an opening to allow medication items to be dispensed therefrom.

50. The system of claim 45 wherein the second surface of said belt of said medication dispensing unit has integrally formed notches to engage said first shaft and said second shaft.

51. The system of claim 45 wherein said first shaft and second shaft of said medication dispensing unit have gears to engage said belt.

52. The system of claim 46 wherein said first cylinder and second cylinder of said medication dispensing unit have gears to engage said belt.

53. The system of claim 45 wherein said microprocessor is connected to said CPU via a card edge connector, said card edge connector supplying power to said microprocessor and providing a serial interface from said microprocessor to said CPU.

54. The system of claim 45 further including a light attached to said medication dispensing unit to indicate when said medication dispensing unit is activated to be loaded or to have a medication item dispensed therefrom.

55. The system of claim 45 wherein said medication dispensing unit further comprises at least one sensor to detect when a medication item is dispensed therefrom, said sensor being connected to said microprocessor to record the information detected by said sensor.

56. The system of claim 45 further comprising a latch mechanism for each of said drawers, wherein said latch mechanism includes a spring, said latch mechanism locks the drawers when the drawers are closed and opens the proper drawers by use of the spring when signalled by the CPU to dispense a medication item.

57. A medication administration system comprising:

a cabinet having a plurality of drawers and compartments;

at least one medication dispensing unit located in at least one of the drawers or compartments, said medication dispensing unit comprising:

a frame;

a first shaft having first and second ends with each of said ends of said first shaft rotatably secured within said frame;

a second shaft having first and second ends with each of said ends of said second shaft rotatably secured within said frame;

a first belt having first and second surfaces, said first belt passing over and around said first and second shafts near the first end of said first and second shafts;

a second belt having first and second surfaces, said second belt passing over and around said first and second shafts near the second end of said first and second shafts;

a plurality of dividers, each having a first and second end, said first end of each of said dividers being secured to said first belt and said second end of each of said dividers being secured to said second belt;

a platform being connected to said frame, said platform being positioned between said first shaft and said second shaft, said platform forming a barrier so that the units of medication items stay within said dividers;

a housing secured to said frame, said housing, in conjunction with said frame, enclosing all or part of said first and second belts, said first and second shafts, said plurality of dividers, and said platform, whereby compartments to hold medication items are formed between said platform, said dividers, said housing and said frame, such that the medication items will not fall out of said unit until the medication items are dispensed from said unit;

a motor operatively connected to at least one of said shafts to rotate said shaft along its axis, the rotation of said shaft causing said belts to move over and around the first shaft and the second shaft, thereby causing the compartments to move within said unit; and

a microprocessor connected to said motor of said medication dispensing unit to enable said medication dispensing unit to be loaded in a controlled manner, and to enable said medication dispensing unit to dispense unit doses of medication in a controlled manner for a particular patient, said microprocessor being capable of receiving and storing information about the type and quantity of the unit doses of medication loaded into said medication dispensing unit, the information in said microprocessor being automatically updated when a unit dose of medication is dispensed from said medication dispensing unit, and said microprocessor containing information about the inventory in said medication dispensing unit at any given time; and

a CPU operatively connected to said microprocessor to communicate information about the medication items loaded and dispensed.

58. The system of claim 57 further comprising a first cylinder around said first shaft and a second cylinder around said second shaft, said first and second cylinders each having first and second ends, said first cylinder having the same axis of rotation as said first shaft and said second cylinder having the same axis of rotation as said second shaft, said first belt passing over and around said first and second cylinders near the first end of said first and second cylinders, and said second belt passing over and around said first and second cylinders near the second end of said first and second cylinders.

59. The system of claim 57 wherein said medication dispensing unit further includes a cam wheel operatively connected to said motor, said cam wheel being operatively connected to one of said shafts to rotate said shaft about its axis.

60. The system of claim 57 wherein said first and second belts of said medication dispensing unit have apertures therethrough and said dividers have extensions extending from the first and second ends of said dividers, said dividers being securable to said first and

second belts by inserting the extensions of said dividers into the apertures of said first and second belts.

61. The system of claim 57 wherein said housing of said medication dispensing unit comprises an opening to allow medication items to be inserted therein and an opening to allow medication items to be dispensed therefrom.

62. The system of claim 57 wherein said microprocessor is connected to said CPU via a card edge connector, said card edge connector supplying power to said microprocessor and providing a serial interface from said microprocessor to said CPU.

63. The system of claim 57 further including a light attached to said medication dispensing unit to indicate when said unit is activated to be loaded or to have a medication item dispensed therefrom.

64. The system of claim 57 further comprising a latch mechanism for each of said drawers, wherein said latch mechanism includes a spring, said latch mechanism locks the drawers when the drawers are closed and opens the proper drawers by use of the spring when signalled by the microprocessor to dispense a medication item.

AMENDED CLAIMS

[received by the International Bureau on 19 June 1995 (19.06.95);
original claims 1-64 replaced by amended claims 1-64 (20 pages)]

1. A medication dispensing and storing unit to be used in a medication administration system, to store and dispense unit doses of medication in a highly controlled manner without allowing a user of the medication dispensing unit to dispense more medication than requested without having the inventory automatically updated, said medication dispensing unit comprising:

a housing having an opening to allow medication items to be inserted therein and said housing having an opening to allow medication items to be dispensed therefrom;

a first shaft having first and second ends with each of said ends of said first shaft rotatably secured within said housing;

a second shaft having first and second ends with each of said ends of said second shaft rotatably secured within said housing;

a conveyor-type belt having a plurality of shelves, said belt passing over said first and second shafts;

a motor operatively connected to one of said shafts to rotate one of said shafts along its axis, the rotation of said shaft causing said belt having the plurality of shelves to move along a continuous path around said first and second shafts; and

a first programmable processor connected to said motor of said medication dispensing and storing unit to enable said medication dispensing and storing unit to be loaded in a controlled manner, and to enable said medication dispensing and storing unit to dispense unit doses of medication in a controlled manner, said first programmable processor being capable of receiving and storing information about at least one of the group comprising the respective

type, quantity, expiration date, lot number, drug code number and other medication information of each of the unit doses of medication loaded onto an assigned shelf of said medication dispensing and storing unit. the information in said first programmable processor being automatically updated when a unit dose of medication is dispensed from said medication dispensing and storing unit, and said first programmable processor containing information about the remaining inventory in said medication dispensing and storing unit.

2. The medication dispensing and storing unit of claim 1 further comprising at least one sensor to detect when a medication item is inserted therein.
3. The medication dispensing and storing unit of claim 1 further comprising at least one sensor to detect when a medication item is dispensed therefrom.
4. The medication dispensing and storing unit of claim 1 further comprising at least one sensor to detect when a shelf of said dispensing and storing unit has a medication item thereon.
5. The medication dispensing and storing unit of claim 1 further comprising first sensors to detect when a medication item is inserted therein, second sensors to detect when a medication item is dispensed therefrom, and third sensors to detect when a shelf of said dispensing and storing unit has a medication item thereon, and all of said sensors being connected to said first programmable processor to record the information detected by said first, second and third sensors.

6. The medication dispensing and storing unit of claim 1 wherein said shelves enable said medication dispensing and storing unit to store and dispense a plurality of unit drug doses in medication items of heterogeneous sizes, shapes and types.
7. The medication dispensing and storing unit of claim 1 wherein the medication items stored and dispensed include one of the group consisting of syringes containing a dose of medicine, ampules containing a dose of medicine, and vials containing a dose of medicine.
8. The medication dispensing and storing unit of claim 1 wherein the opening of said housing to allow medication items to be inserted therein defines a template with an opening shaped like the medication item to be inserted therein.
9. The medication dispensing and storing unit of claim 1 wherein the opening of said housing to allow medication items to be dispensed therefrom includes a door actuated by a solenoid to open the door to dispense a medication item, said solenoid being connected to said first programmable processor.
10. The system of claim 1 wherein said housing is made of plexiglass to enable an individual to perform a visual inspection of said medication dispensing and storing unit and to perform a visual inventory of the medication items in said medication dispensing and storing unit.
11. A medication administration system comprising:
a cabinet having a plurality of drawers and compartments;

at least one medication dispensing and storing unit located in at least one of the compartments or drawers. said dispensing and storing unit being modular and removable from said system. said medication dispensing and storing unit comprising:

a housing having an opening to allow medication items to be inserted therein and said housing having an opening to allow medication items to be dispensed therefrom;

a first shaft having first and second ends with each of said ends of said first shaft rotatably secured within said housing;

a second shaft having first and second ends with each of said ends of said second shaft rotatably secured within said housing;

a conveyor-type belt having a plurality of shelves, said belt passing over said first and second shafts;

a motor operatively connected to one of said shafts to rotate one of said shafts along its axis, the rotation of said shaft causing said belt having the plurality of shelves to move along a continuous path around said first and second shafts, and

a first programmable processor connected to said motor of said medication dispensing and storing unit to enable said medication dispensing and storing unit to be loaded in a controlled manner, and to enable said medication dispensing and storing unit to dispense unit doses of medication in a controlled manner, said first programmable processor being capable of receiving and storing information about at least one of the group comprising the respective type, quantity, expiration date, lot number, drug code number and other medication information of each of the unit doses of

medication loaded onto an assigned shelf of said medication dispensing and storing unit, the information in said first programmable processor being automatically updated when a unit dose of medication is dispensed from said medication dispensing and storing unit, and said first programmable processor containing information about the remaining inventory in said medication dispensing and storing unit; and a second programmable processor in said cabinet, said second programmable processor being operatively connected to said first programmable processor and to at least one of said drawers or compartments.

12. The system of claim 11 wherein said medication dispensing and storing unit further comprises at least one sensor to detect when a medication item is inserted into said medication dispensing and storing unit.

13. The system of claim 11 wherein said medication dispensing and storing unit further comprises at least one sensor to detect when a medication item is dispensed from said medication dispensing and storing unit.

14. The system of claim 11 wherein said second programmable processor is capable of receiving input of user information, patient information and medication information, said second programmable processor being operatively connected to said first programmable processor to enable the first and second programmable processors to transfer information to and from each other regarding at least one of the group comprising the respective type, quantity, expiration date, lot number, drug code number and other medication

information of each of the unit doses of medication loaded into said medication dispensing and storing unit and dispensed from said medication dispensing and storing unit.

15. The system of claim 14 wherein said second programmable processor uses information from the first programmable processor of each of said dispensing and storing units regarding at least one of the group comprising the respective type, quantity, expiration date, lot number, drug code number and other medication information of each of the unit doses of medication loaded into said medication dispensing and storing units and dispensed from said medication dispensing and storing units to determine the remaining inventory in said medication dispensing and storing units and said system.

16. The system of claim 11 further comprising a keyboard, touch screen or other input device connectable to said second programmable processor to enable a user to input information.

17. The system of claim 11 further comprising a latch mechanism for each of said drawers, said latch mechanism locks the drawers when the drawers are closed and opens the proper drawers when signalled by said second programmable processor to dispense medication.

18. The system of claim 11 wherein said cabinet is portable with rolling means connected to the bottom of said cabinet.

19. The system of claim 11 wherein said medication dispensing and storing unit further comprises first sensors to detect when a medication item is inserted therein, second sensors to detect when a medication item is dispensed therefrom, and third sensors to detect when a shelf of said dispensing and storing unit has a medication item thereon, and all of said sensors being connected to said first programmable processor to record the information detected by said first, second and third sensors.

20. The system of claim 11 wherein the opening of said housing to allow medication items to be dispensed therefrom includes a door actuated by a solenoid to open the door to dispense a medication item, said solenoid being connected to said first programmable processor.

21. A medication administration system comprising:
a cabinet having a plurality of drawers and compartments;
at least one medication dispensing and storing unit located in at least one of the compartments, said dispensing and storing unit including:
a programmable processor connected to said medication dispensing and storing unit to dispense medication;
a housing having an opening to allow medication items to be inserted therein, said housing including a door actuated by a solenoid to open the door to dispense a medication item, said solenoid being connected to said programmable processor.

a first shaft having first and second ends with each of said ends of said first shaft rotatably secured within said housing;

a second shaft having first and second ends with each of said ends of said second shaft rotatably secured within said housing;

a conveyor-type belt having a plurality of shelves, said belt passing over said first and second shafts; and

a motor operatively connected to one of said shafts to rotate one of said shafts along its axis, the rotation of said shaft causing said belt having the plurality of shelves to move along a continuous path around said first and second shafts.

22. A medication dispensing and storing unit comprising:

a programmable processor connected to said medication dispensing and storing unit to dispense medication;

a housing having an opening to allow medication items to be inserted therein, said housing including a door actuated by a solenoid to open the door to dispense a medication item, said solenoid being connected to said programmable processor:

a first shaft having first and second ends with each of said ends of said first shaft rotatably secured within said housing;

a second shaft having first and second ends with each of said ends of said second shaft rotatably secured within said housing;

a conveyor-type belt having a plurality of shelves, said belt passing over said first and second shafts; and

a motor operatively connected to one of said shafts to rotate one of said shafts along its axis, the rotation of said shaft causing said belt having the plurality of shelves to move along a continuous path around said first and second shafts.

23. A medication dispensing and storing unit for dispensing one or more single units of medication items comprising:

a frame;

a first shaft having first and second ends with each of said ends of said first shaft rotatably secured within said frame;

a second shaft having first and second ends with each of said ends of said second shaft rotatably secured within said frame;

at least one belt having first and second surfaces, said belt passing over and around said first and second shafts;

a housing secured to said frame, said housing, in conjunction with said frame, enclosing all or part of said belt, first shaft and second shaft, such that the medication items will not fall out of said unit until the medication items are dispensed from said unit;

a motor operatively connected to at least one of said shafts to rotate said shaft along its axis, the rotation of said shaft causing the belt to move over and around the first shaft and the second shaft: and

a microprocessor connected to said motor of said medication dispensing and storing unit to enable said medication dispensing and storing unit to be loaded in a controlled manner, and to enable said medication dispensing and storing unit to dispense unit doses of medication in a controlled manner, said microprocessor being capable of receiving and storing information about at least one of the group comprising the respective type, quantity, expiration date, lot number, drug code number and other medication information of the unit doses of medication loaded into said medication dispensing and storing unit, the information in said microprocessor being automatically updated when a unit dose of medication is dispensed from said medication dispensing and storing unit, and said microprocessor containing information about the inventory in said medication dispensing and storing unit.

24. The unit of claim 23 further comprising a first cylinder around said first shaft and a second cylinder around said second shaft, said first and second cylinders each having first and second ends, said first cylinder having the same axis of rotation as said first shaft and said second cylinder having the same axis of rotation as said second shaft, said belt passing over and around said first and second cylinders.

25. The unit of claim 23 wherein the first surface of said belt has integrally formed article receiving compartments to hold medication items.

26. The unit of claim 23 wherein said belt has apertures therethrough to hold a plurality of dividers arranged along said belt.

27. The unit of claim 23 wherein said housing includes an opening to allow medication items to be inserted therein and an opening to allow medication items to be dispensed therefrom.

28. The unit of claim 23 wherein the opening to allow medication items to be dispensed from said unit includes a door connected to a solenoid to open the door to dispense a medication item, said solenoid being operatively connected to said microprocessor.

29. The unit of claim 23 wherein the second surface of said belt has integrally formed notches to engage said first shaft and said second shaft.

30. The unit of claim 24 wherein said first cylinder and second cylinder have gears to engage said belt.

31. The unit of claim 23 wherein said microprocessor is connected to a card edge connector that supplies power to said microprocessor.

32. The unit of claim 23 further including a light attached to said unit to indicate when said unit is activated to be loaded or to have a medication item dispensed therefrom.

33. The unit of claim 23 further comprising at least one sensor to detect when a medication item is inserted therein, said sensor being connected to said microprocessor to record the information detected by said sensor.

34. The unit of claim 23 further comprising at least one sensor to detect when a medication item is dispensed therefrom, said sensor being connected to said microprocessor to record the information detected by said sensor.

35. A medication dispensing and storing unit for dispensing one or more single units of medication items comprising:

a frame;

a first shaft having first and second ends with each of said ends of said first shaft rotatably secured within said frame;

a second shaft having first and second ends with each of said ends of said second shaft rotatably secured within said frame;

a first belt having first and second surfaces, said first belt passing over and around said first and second shafts near the first end of said first and second shafts;

a second belt having first and second surfaces, said second belt passing over and around said first and second shafts near the second end of said first and second shafts;

a plurality of dividers, each having a first and second end, said first end of each of said dividers being secured to said first belt and said second end of each of said dividers being secured to said second belt;

a platform being connected to said frame, said platform being positioned between said first shaft and said second shaft, said platform forming a barrier so that the units of medication items stay within said dividers;

a housing secured to said frame, said housing, in conjunction with said frame, enclosing all or part of said first and second belts, said first and second shafts, said plurality of dividers, and said platform, whereby compartments to hold medication items are formed between said platform, said dividers, said housing and said frame.

such that the medication items will not fall out of said unit until the medication items are dispensed from said unit;

a motor operatively connected to at least one of said shafts to rotate said shaft along its axis, the rotation of said shaft causing said belts to move over and around the first shaft and the second shaft, thereby causing the compartments to move within said unit; and

a microprocessor connected to said motor of said medication dispensing and storing unit to enable said medication dispensing and storing unit to be loaded in a controlled manner, and to enable said medication dispensing and storing unit to dispense unit doses of medication in a controlled manner, said microprocessor being capable of receiving and storing information about at least one of the group comprising the respective type, quantity, expiration date, lot number, drug code number and other medication information of the unit doses of medication loaded into said medication dispensing and storing unit, the information in said microprocessor being automatically updated when a unit dose of medication is dispensed from said medication dispensing and storing unit, and said microprocessor containing information about the inventory in said medication dispensing and storing unit.

36. The unit of claim 35 further comprising a first cylinder around said first shaft and a second cylinder around said second shaft, said first and second cylinders each having first and second ends, said first cylinder having the same axis of rotation as said first shaft and said second cylinder having the same axis of rotation as said second shaft, said first belt passing over and around said first and second cylinders near the first end of said first and second cylinders, and said second belt passing over and around said first and second cylinders near the second end of said first and second cylinders.

37. The unit of claim 35 wherein said motor is operatively connected to at least one of said shafts by a cam wheel.

38. The unit of claim 35 wherein said first and second belts have apertures therethrough and said dividers have extensions extending from the first and second ends of

said dividers, said dividers being securable to said first and second belts by inserting the extensions of said dividers into the apertures of said first and second belts.

39. The unit of claim 35 wherein said housing comprises an opening to allow medication items to be inserted therein and an opening to allow medication items to be dispensed therefrom.

40. The unit of claim 35 wherein the opening to allow medication items to be dispensed from said unit includes a door connected to a solenoid to open the door to dispense a medication item, said solenoid being operatively connected to said microprocessor.

41. The unit of claim 35 wherein said first shaft and second shaft have gears to engage said belts.

42. The unit of claim 36 wherein said first cylinder and second cylinder have gears to engage said belts.

43. The unit of claim 35 wherein said microprocessor is connected to a card edge connector that supplies power to said microprocessor.

44. The unit of claim 35 further including a light attached to said unit to indicate when said unit is activated to be loaded or to have a medication item dispensed therefrom.

45. A medication administration system comprising:
a cabinet having a plurality of drawers and compartments:

at least one medication dispensing and storing unit located in at least one of the drawers or compartments, said medication dispensing and storing unit comprising:

a frame;

a first shaft having first and second ends with each of said ends of said first shaft rotatably secured within said frame;

a second shaft having first and second ends with each of said ends of said second shaft rotatably secured within said frame;

at least one belt having first and second surfaces, said belt passing over and around said first and second shafts;

a housing secured to said frame, said housing, in conjunction with said frame, enclosing all or part of said belt, first shaft and second shaft, such that the medication items will not fall out of said unit until the medication items are dispensed from said unit;

a motor operatively connected to at least one of said shafts to rotate said shaft along its axis, the rotation of said shaft causing the belt to move over and around the first shaft and the second shaft; and

a microprocessor connected to said motor of said medication dispensing and storing unit to enable said medication dispensing and storing unit to be loaded in a controlled manner, and to enable said medication dispensing and storing unit to dispense unit doses of medication in a controlled manner, said microprocessor being capable of receiving and storing information about at least one of the group comprising the respective type, quantity, expiration date, lot number, drug code number and other medication information of the unit doses of medication loaded into said medication dispensing and storing unit, the information in said microprocessor being automatically updated when a unit dose of medication is dispensed from said medication dispensing and storing unit, and said microprocessor containing information about the inventory in said medication dispensing and storing unit; and

a CPU operatively connected to said microprocessor to communicate information about the medication items loaded and dispensed.

46. The system of claim 45 wherein said medication dispensing and storing unit further comprises a first cylinder around said first shaft and a second cylinder around said second shaft. said first and second cylinders each having first and second ends. said first

cylinder having the same axis of rotation as said first shaft and said second cylinder having the same axis of rotation as said second shaft. said belt passing over and around said first and second cylinders.

47. The system of claim 45 wherein the first surface of said belt of said medication dispensing and storing unit has integrally formed article receiving compartments or shelves to hold medication items.

48. The system of claim 45 wherein said belt of said medication dispensing and storing unit has apertures therethrough to hold a plurality of dividers arranged along said belt.

49. The system of claim 45 wherein said housing of said medication dispensing and storing unit includes an opening to allow medication items to be inserted therein and an opening to allow medication items to be dispensed therefrom.

50. The system of claim 45 wherein the second surface of said belt of said medication dispensing and storing unit has integrally formed notches to engage said first shaft and said second shaft.

51. The system of claim 45 wherein said first shaft and second shaft of said medication dispensing and storing unit have gears to engage said belt.

52. The system of claim 46 wherein said first cylinder and second cylinder of said medication dispensing and storing unit have gears to engage said belt.

53. The system of claim 45 wherein said microprocessor is connected to said CPU via a card edge connector, said card edge connector supplying power to said microprocessor and providing a serial interface from said microprocessor to said CPU.

54. The system of claim 45 further including a light attached to said medication dispensing and storing unit to indicate when said medication dispensing and storing unit is activated to be loaded or to have a medication item dispensed therefrom.

55. The system of claim 45 wherein said medication dispensing and storing unit further comprises at least one sensor to detect when a medication item is dispensed therefrom, said sensor being connected to said microprocessor to record the information detected by said sensor.

56. The system of claim 45 further comprising a latch mechanism for each of said drawers, wherein said latch mechanism locks the drawers when the drawers are closed and opens the proper drawers when signalled by the CPU to dispense a medication item.

57. A medication administration system comprising:

a cabinet having a plurality of drawers and compartments:

at least one medication dispensing and storing unit located in at least one of the drawers or compartments, said medication dispensing and storing unit comprising:

a frame;

a first shaft having first and second ends with each of said ends of said first shaft rotatably secured within said frame;

a second shaft having first and second ends with each of said ends of said second shaft rotatably secured within said frame;

a first belt having first and second surfaces, said first belt passing over and around said first and second shafts near the first end of said first and second shafts;

a second belt having first and second surfaces, said second belt passing over and around said first and second shafts near the second end of said first and second shafts;

a plurality of dividers, each having a first and second end, said first end of each of said dividers being secured to said first belt and said second end of each of said dividers being secured to said second belt;

a platform being connected to said frame, said platform being positioned between said first shaft and said second shaft, said platform forming a barrier so that the units of medication items stay within said dividers;

a housing secured to said frame, said housing, in conjunction with said frame, enclosing all or part of said first and second belts, said first and second shafts, said plurality of dividers, and said platform, whereby compartments to hold medication items are formed between said platform, said dividers, said housing and said frame, such that the medication items will not fall out of said unit until the medication items are dispensed from said unit;

a motor operatively connected to at least one of said shafts to rotate said shaft along its axis, the rotation of said shaft causing said belts to move over and around the first shaft and the second shaft, thereby causing the compartments to move within said unit; and

a microprocessor connected to said motor of said medication dispensing and storing unit to enable said medication dispensing and storing unit to be loaded in a controlled manner, and to enable said medication dispensing and storing unit to dispense unit doses of medication in a controlled manner, said microprocessor being capable of receiving and storing information about at least one of the group comprising the respective type, quantity, expiration date, lot number, drug code number and other medication information of the unit doses

of medication loaded into said medication dispensing and storing unit, the information in said microprocessor being automatically updated when a unit dose of medication is dispensed from said medication dispensing and storing unit, and said microprocessor containing information about the inventory in said medication dispensing and storing unit; and

a CPU operatively connected to said microprocessor to communicate information about the medication items loaded and dispensed.

58. The system of claim 57 further comprising a first cylinder around said first shaft and a second cylinder around said second shaft, said first and second cylinders each having first and second ends, said first cylinder having the same axis of rotation as said first shaft and said second cylinder having the same axis of rotation as said second shaft, said first belt passing over and around said first and second cylinders near the first end of said first and second cylinders, and said second belt passing over and around said first and second cylinders near the second end of said first and second cylinders.

59. The system of claim 57 wherein said medication dispensing and storing unit further includes a cam wheel operatively connected to said motor, said cam wheel being operatively connected to one of said shafts to rotate said shaft about its axis.

60. The system of claim 57 wherein said first and second belts of said medication dispensing and storing unit have apertures therethrough and said dividers have extensions extending from the first and second ends of said dividers, said dividers being securable to said first and

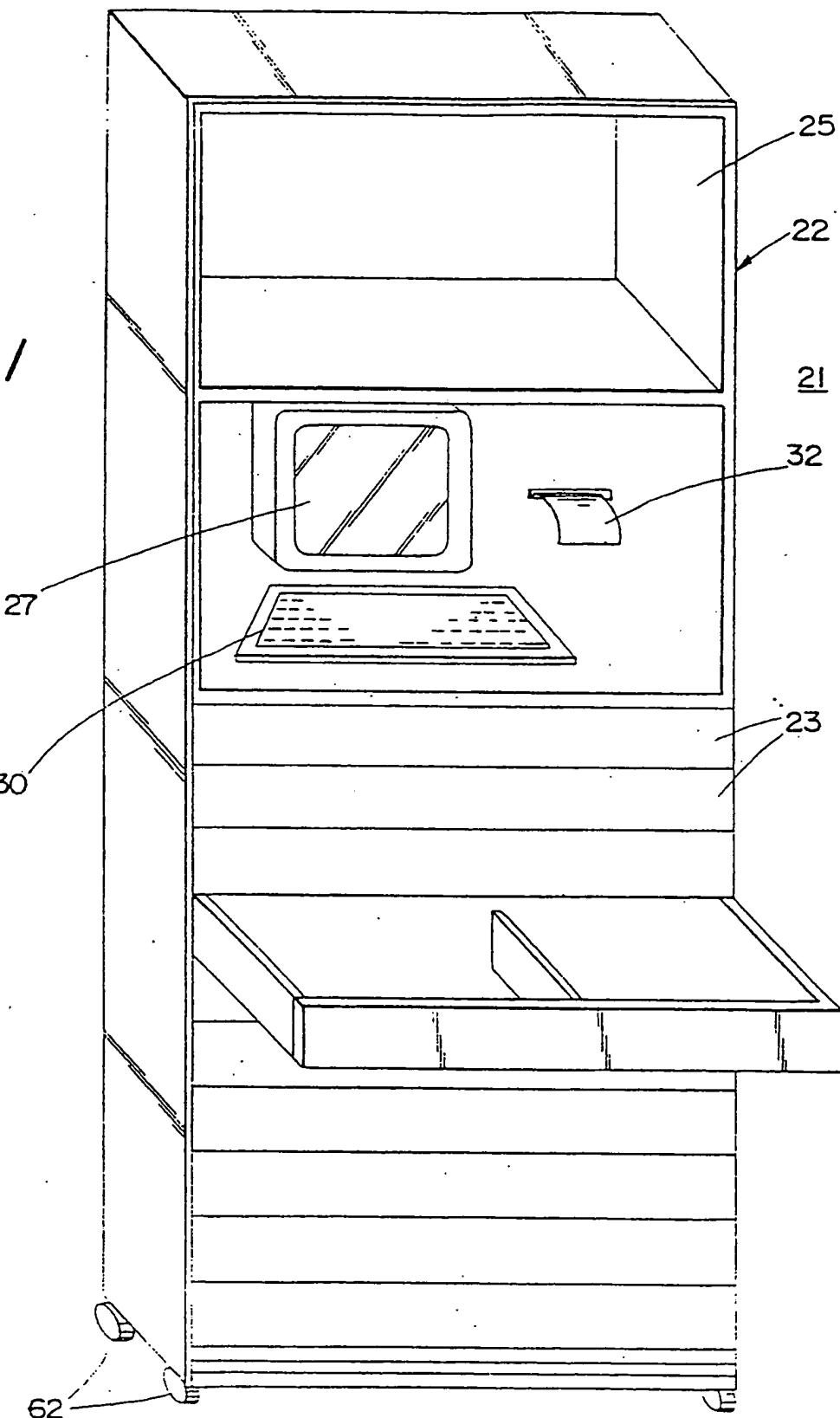
second belts by inserting the extensions of said dividers into the apertures of said first and second belts.

61. The system of claim 57 wherein said housing of said medication dispensing and storing unit comprises an opening to allow medication items to be inserted therein and an opening to allow medication items to be dispensed therefrom.

62. The system of claim 57 wherein said microprocessor is connected to said CPU via a card edge connector, said card edge connector supplying power to said microprocessor and providing a serial interface from said microprocessor to said CPU.

63. The system of claim 57 further including a light attached to said medication dispensing and storing unit to indicate when said unit is activated to be loaded or to have a medication item dispensed therefrom.

64. The system of claim 57 further comprising a latch mechanism for each of said drawers, wherein said latch mechanism locks the drawers when the drawers are closed and opens the proper drawers when signalled by the microprocessor to dispense a medication item.

Fig. 1

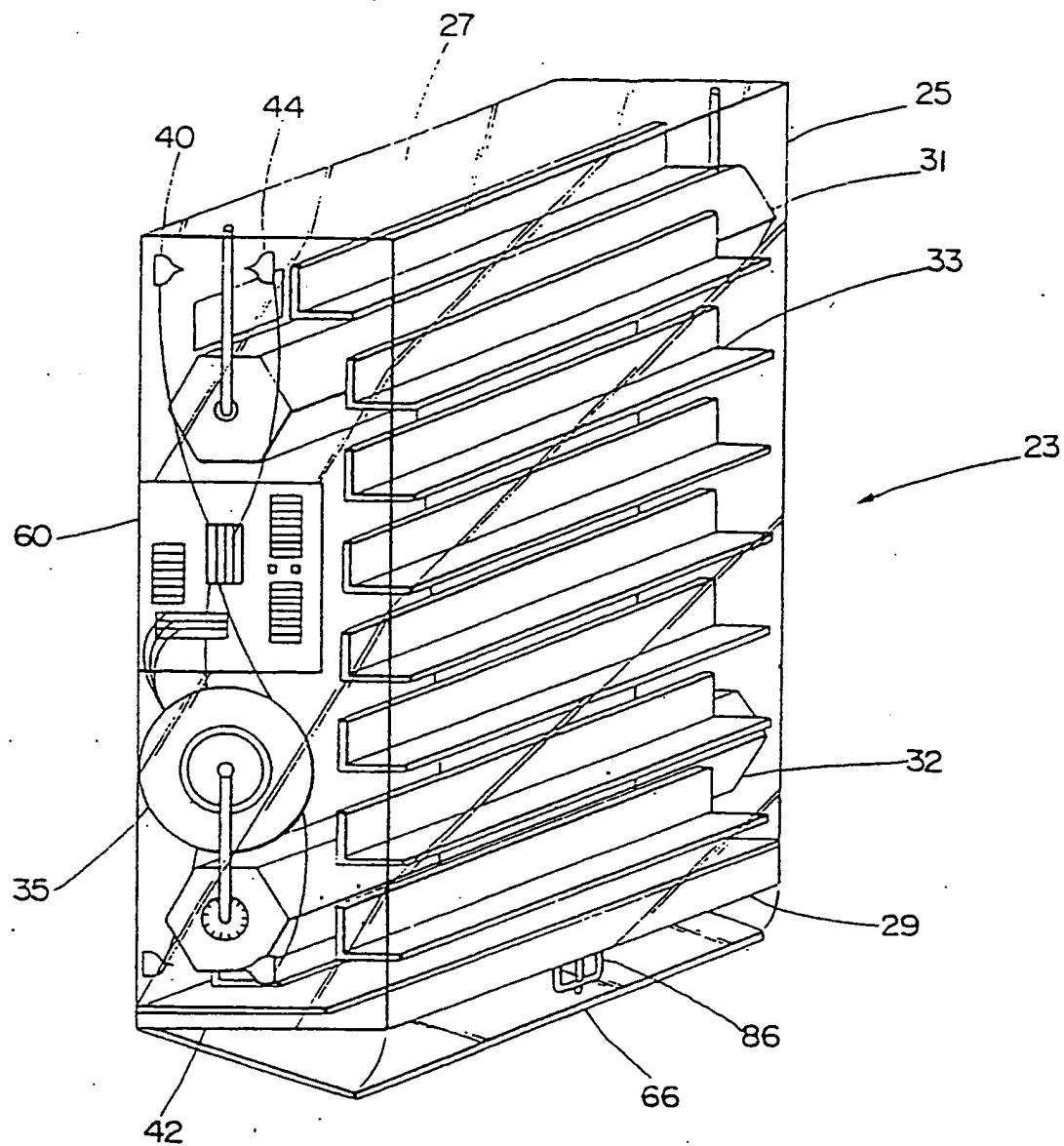


Fig. 2

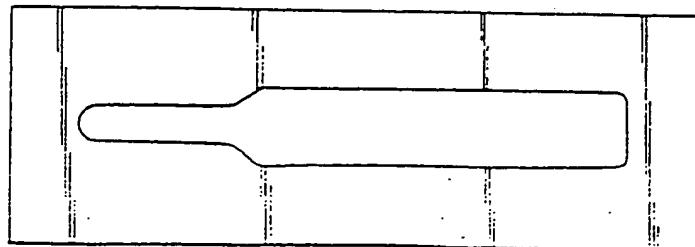


Fig. 3

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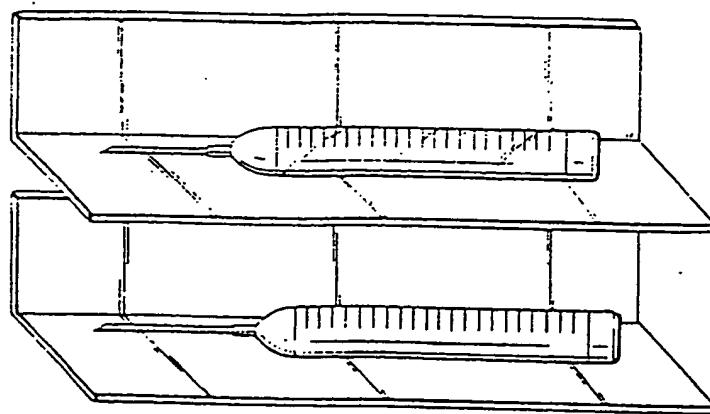
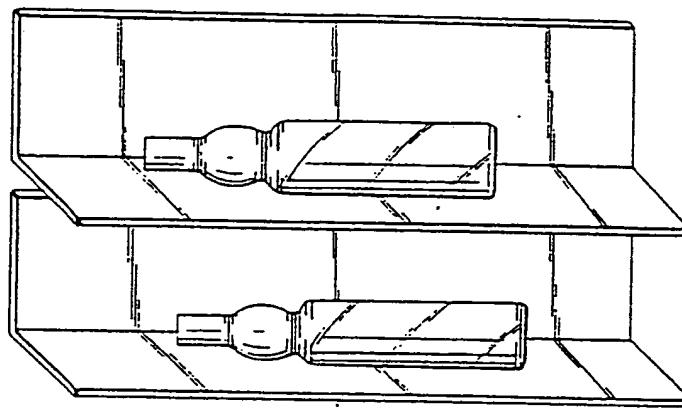
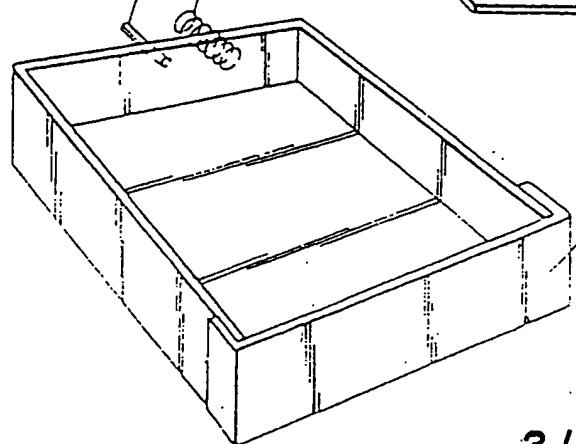
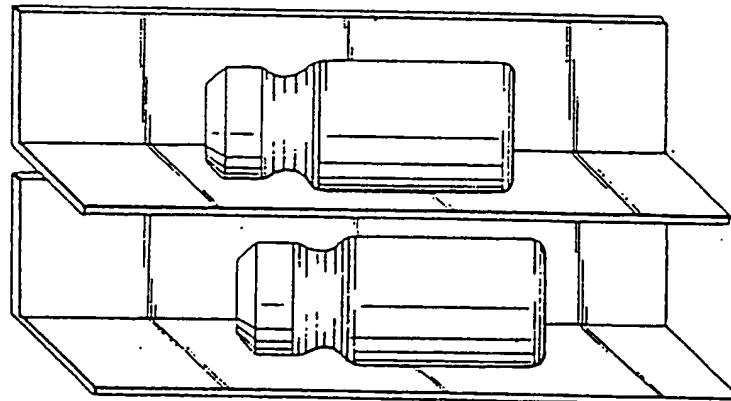
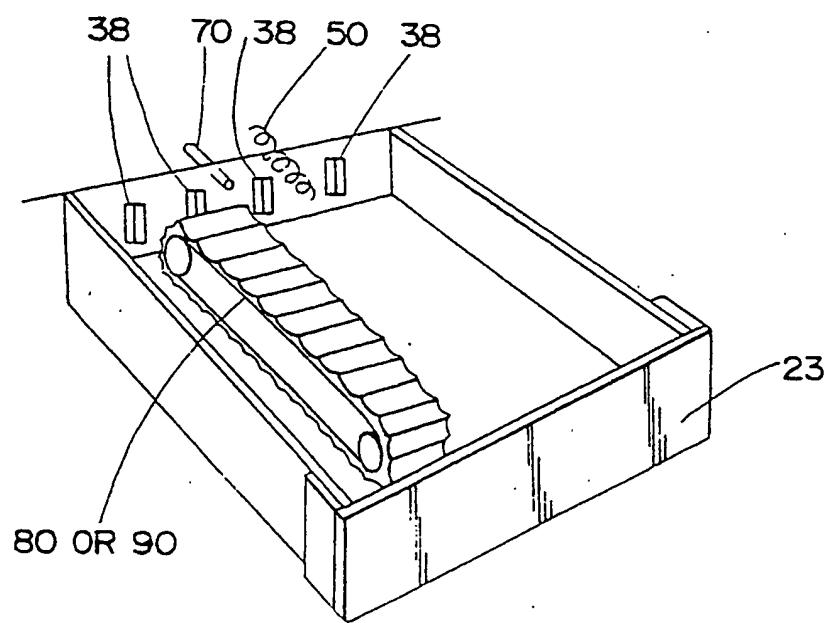
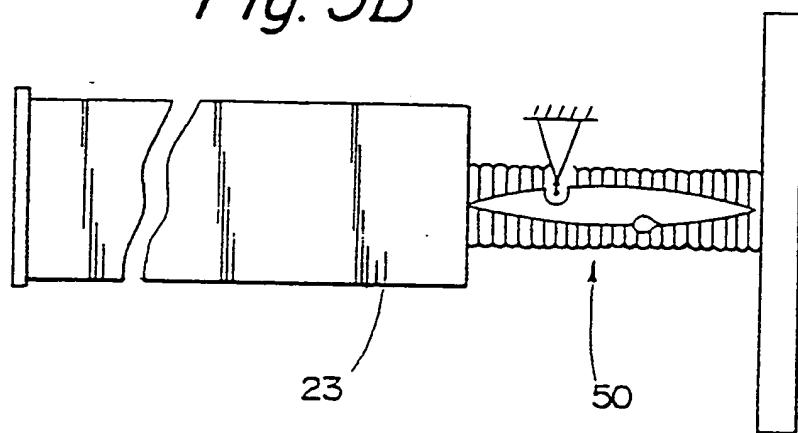
Fig. 4A*Fig. 4B**Fig. 4C**Fig. 5*

Fig. 5B*Fig. 5A*

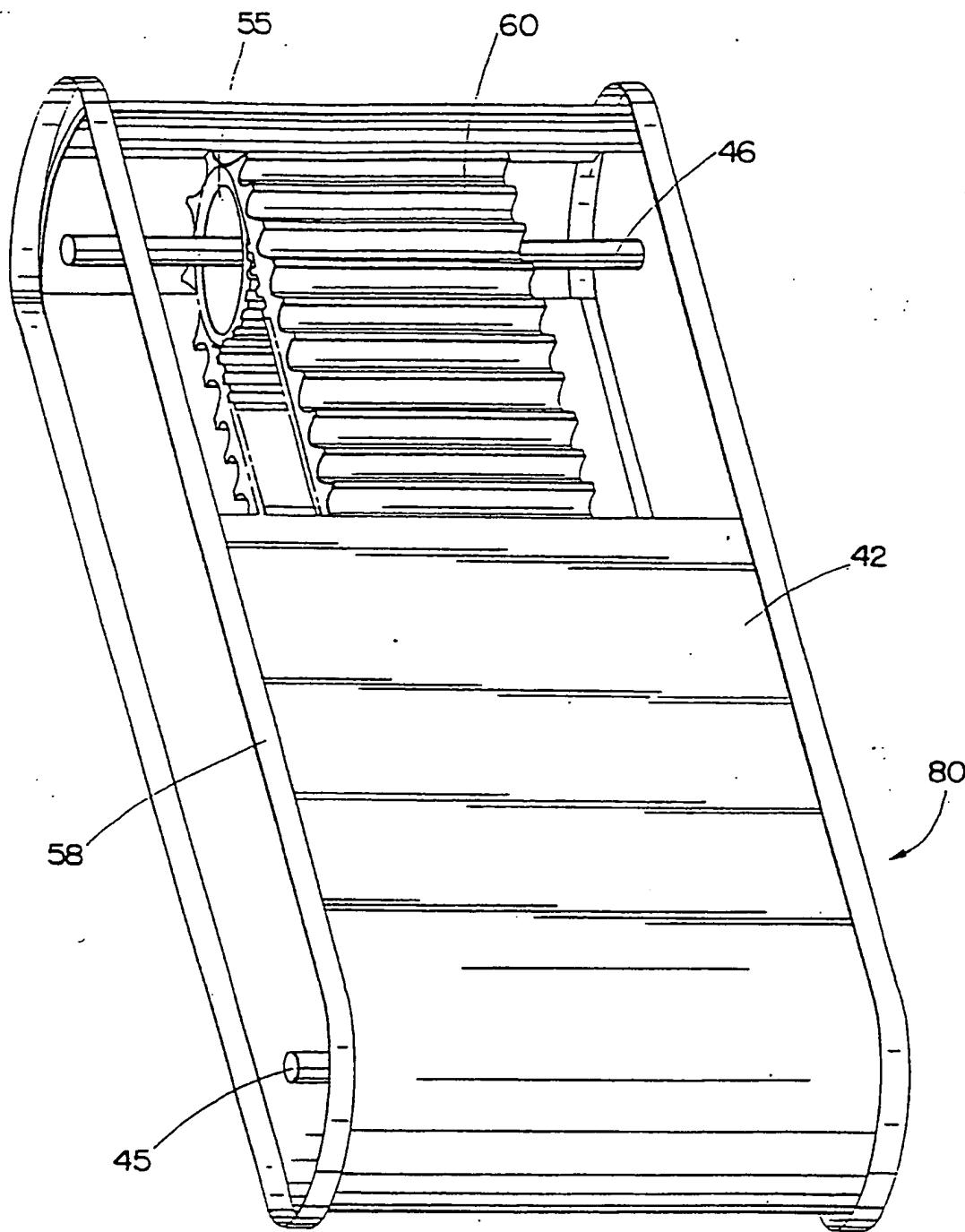


Fig. 6

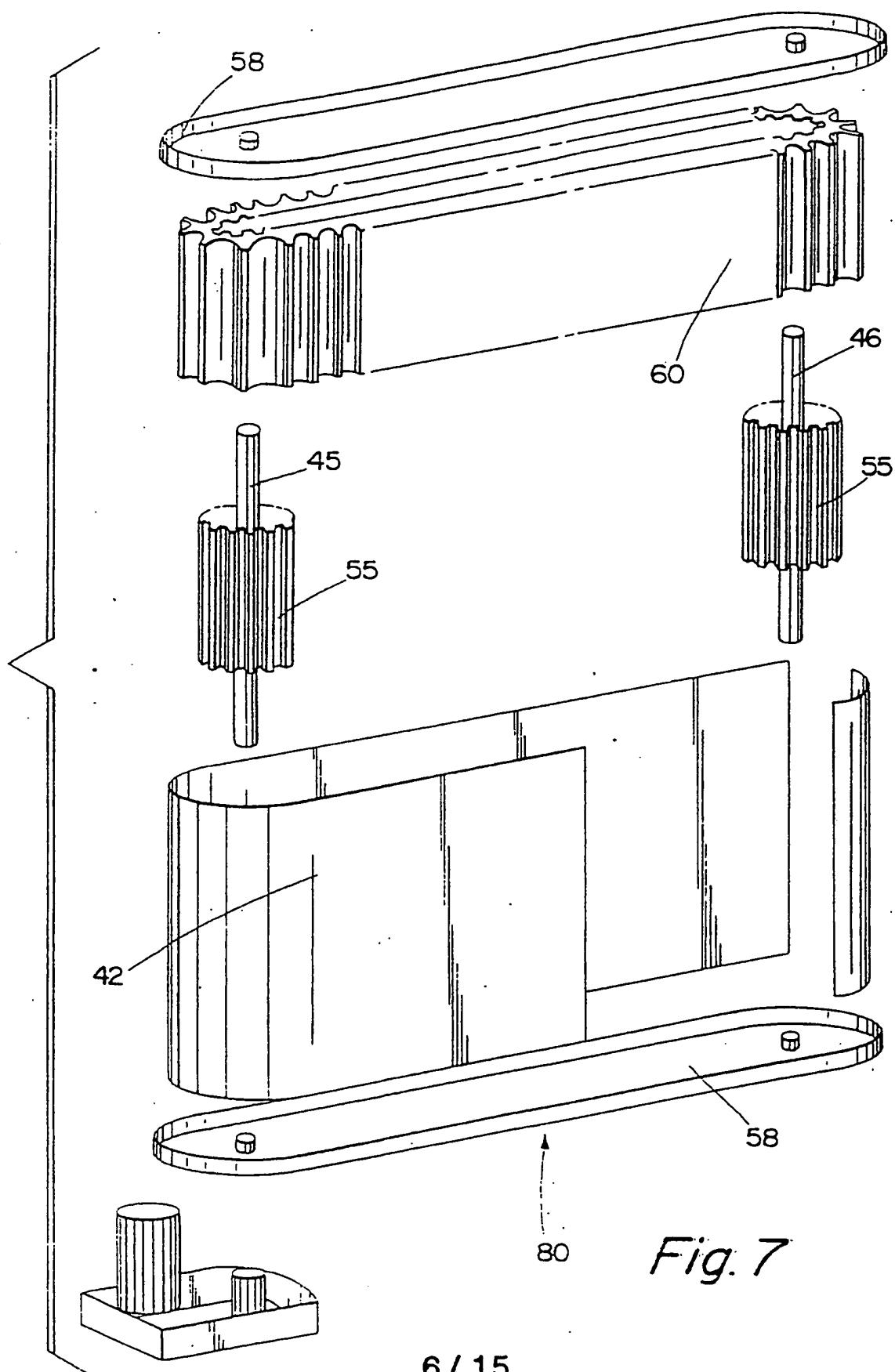


Fig. 7

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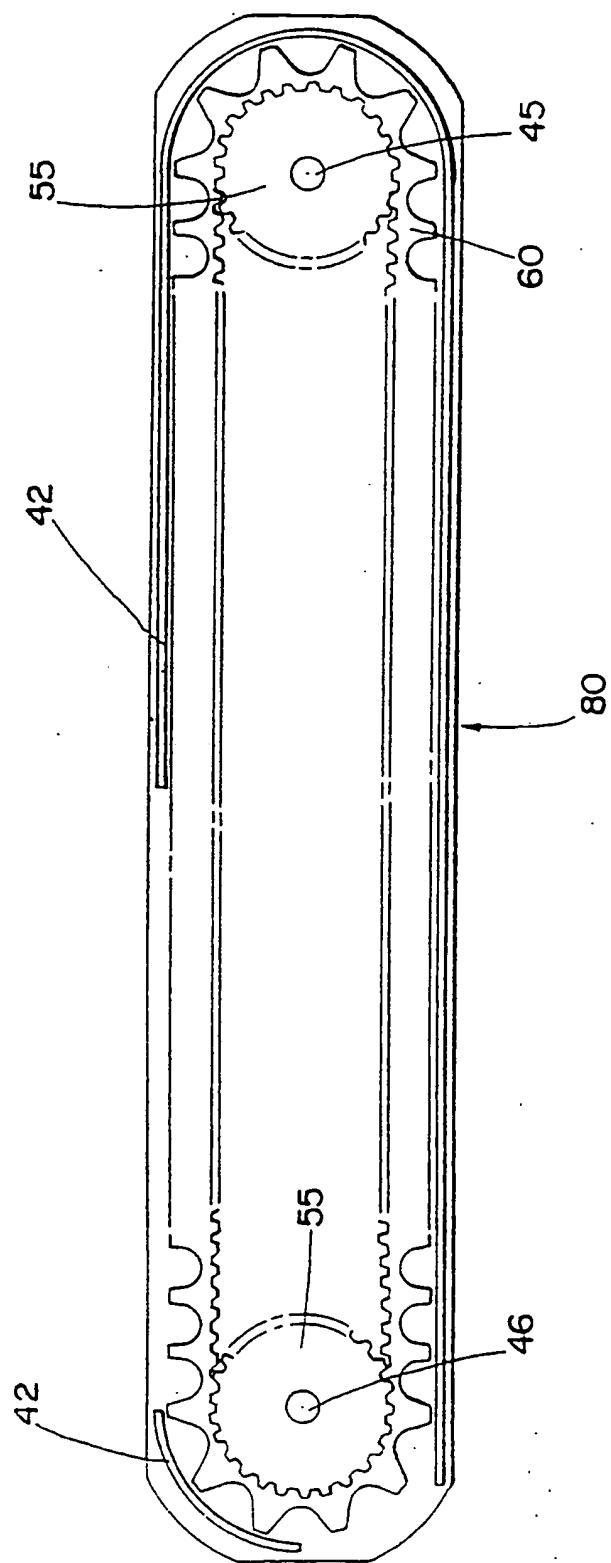


Fig. 8

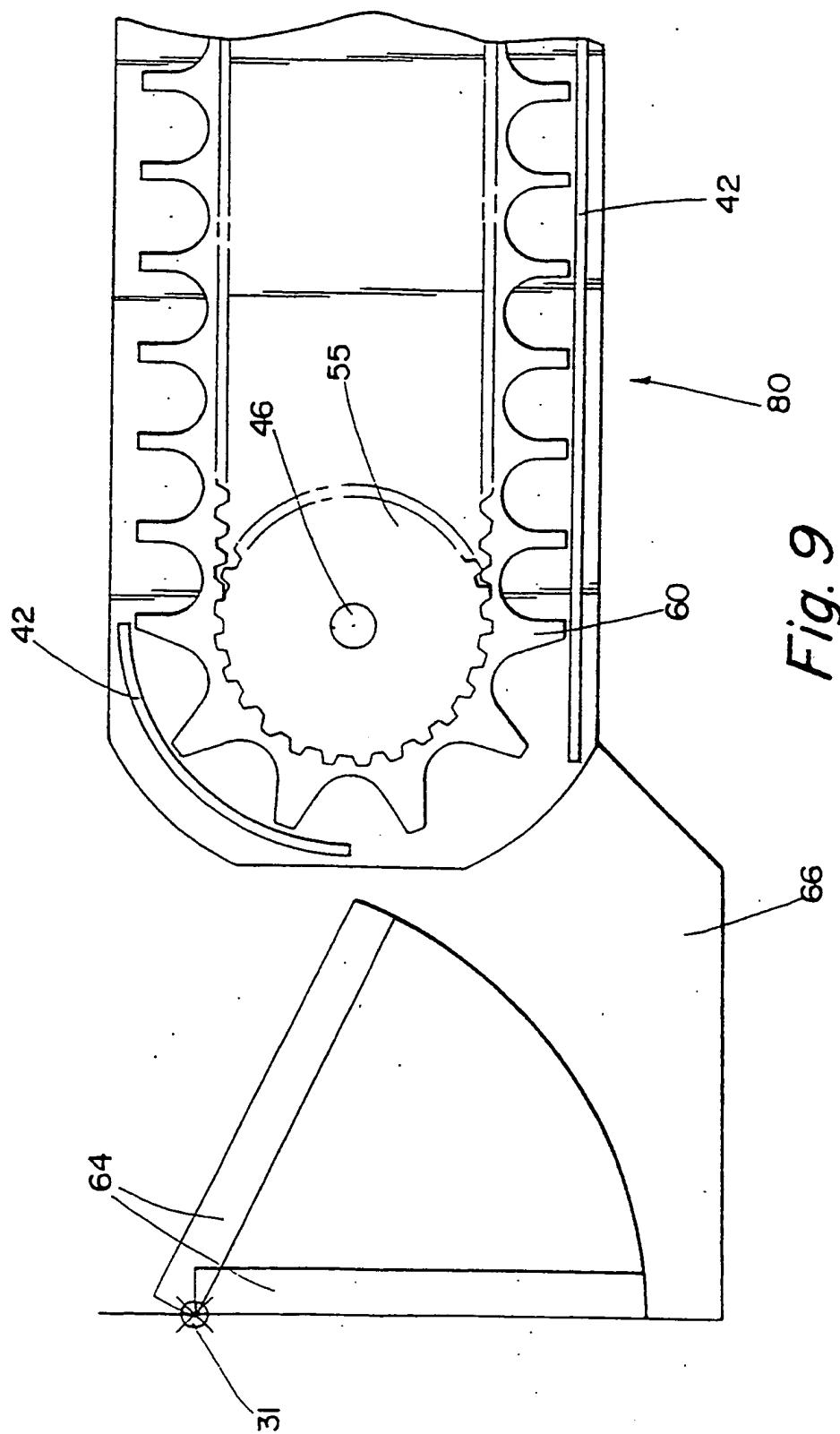


Fig. 9

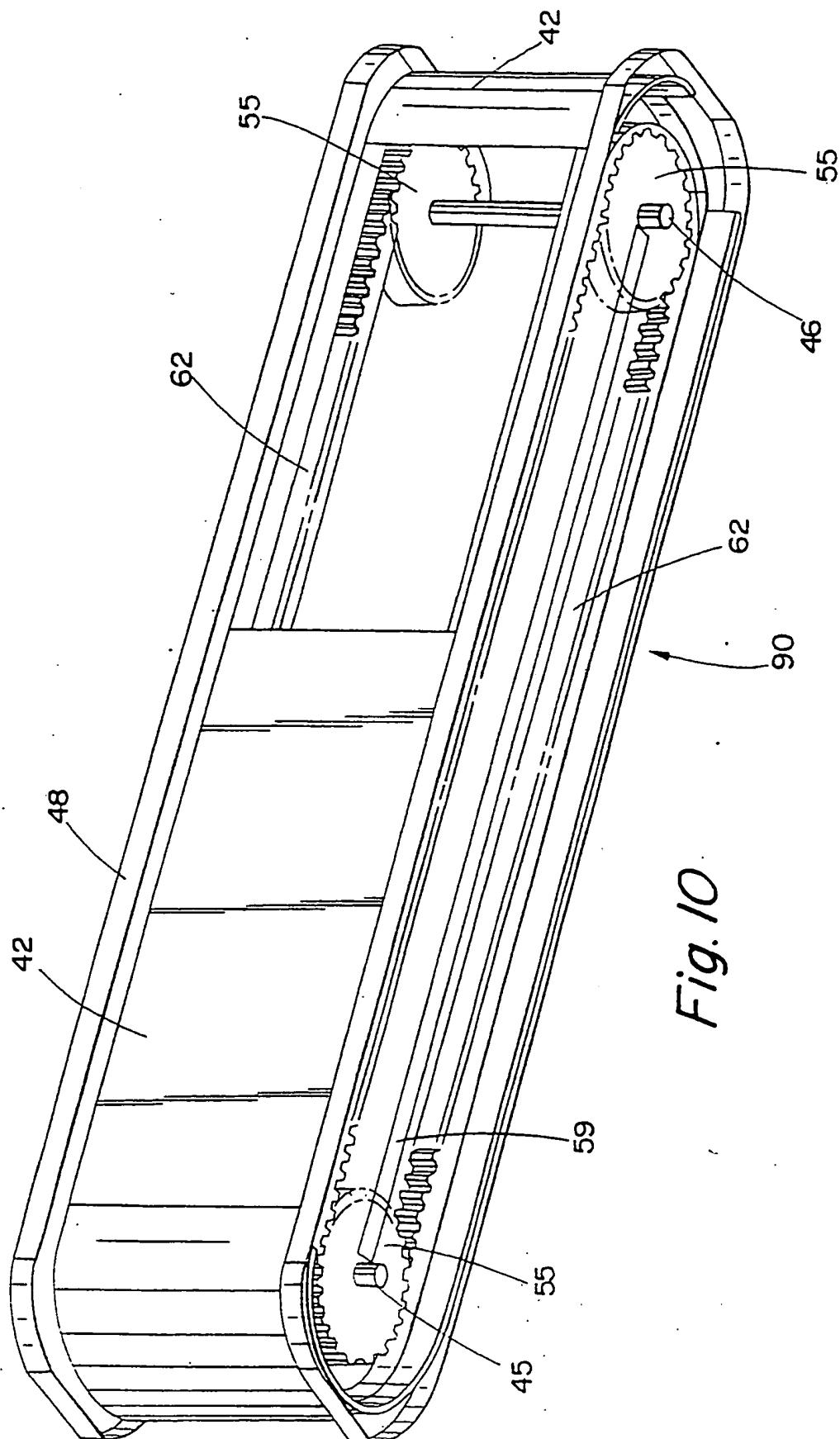


Fig. 10

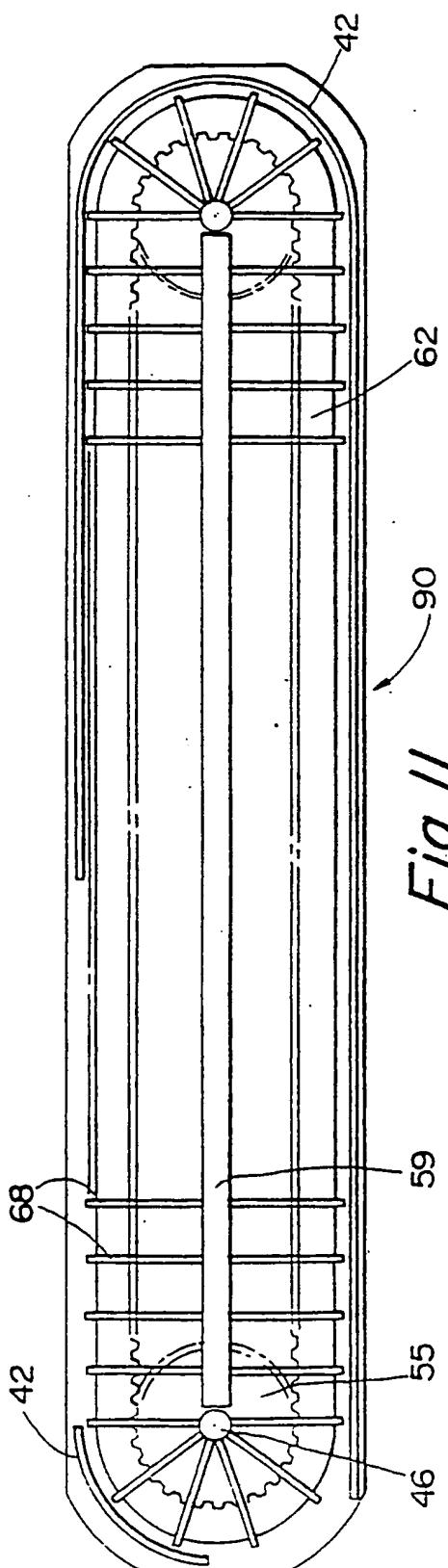


Fig. 11

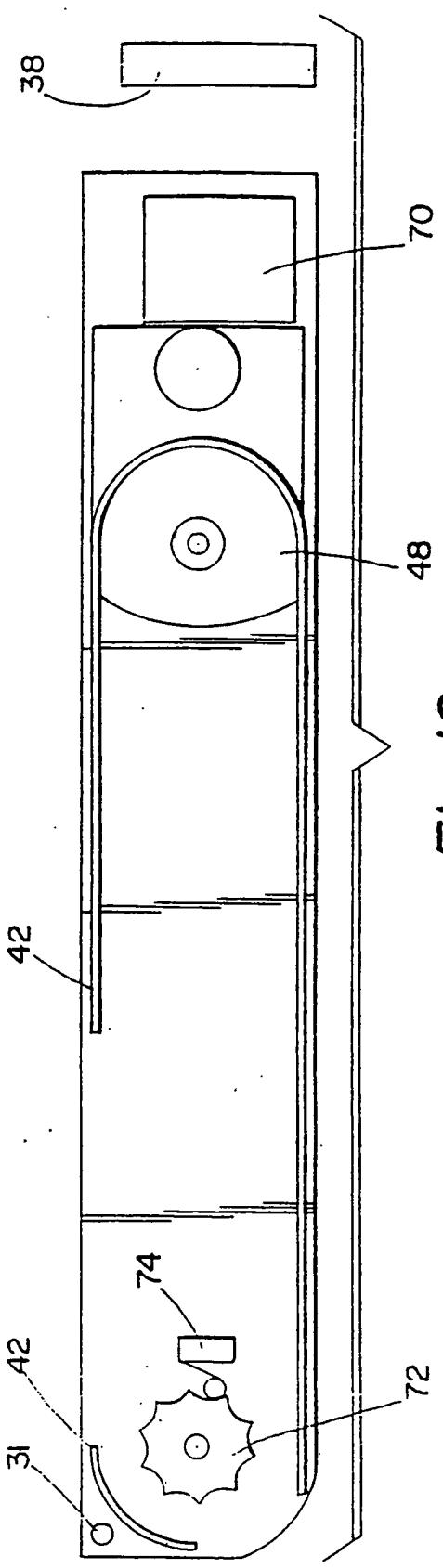


Fig. 12

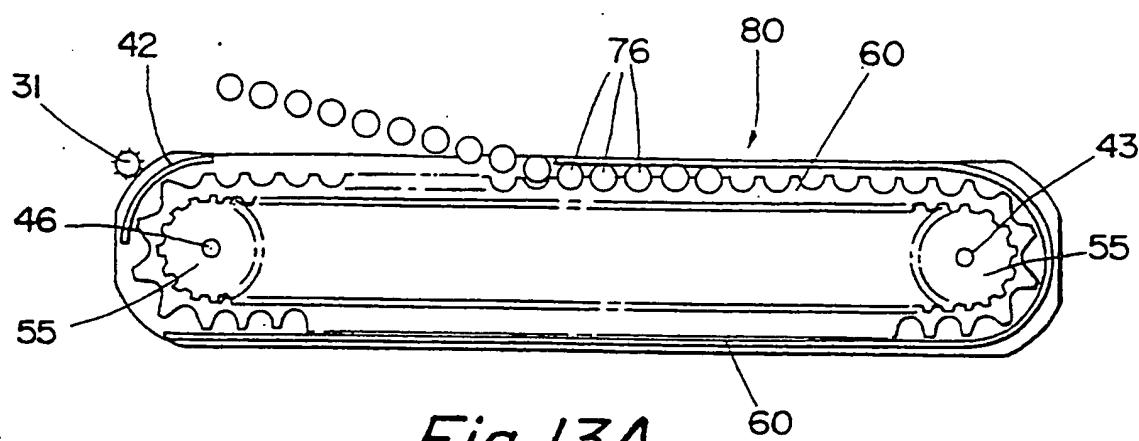


Fig. 13A

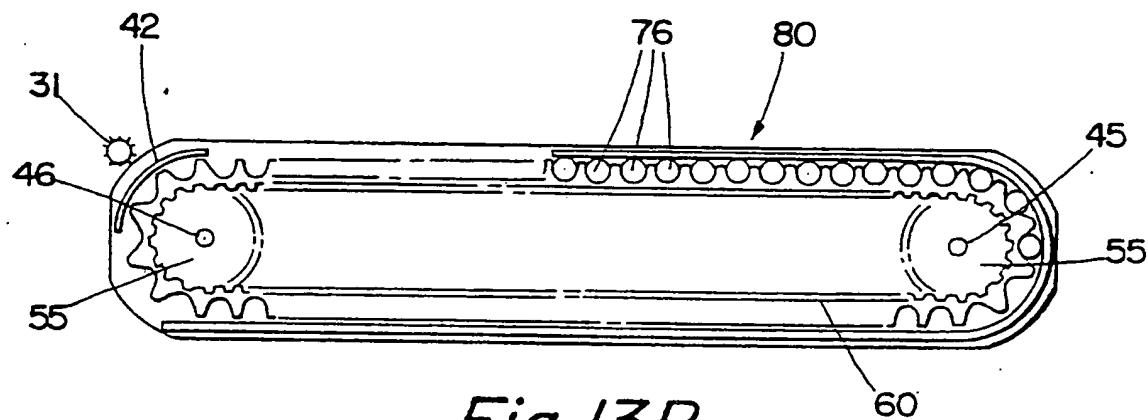


Fig. 13B

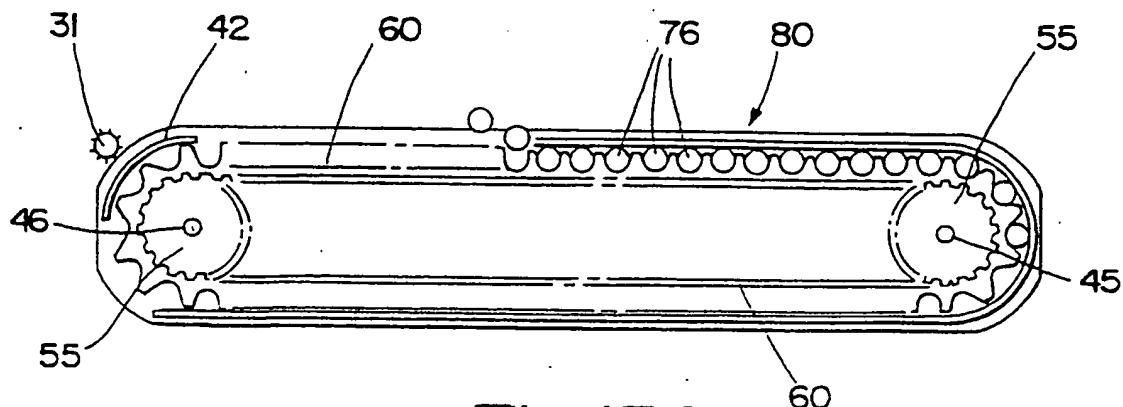


Fig. 13C

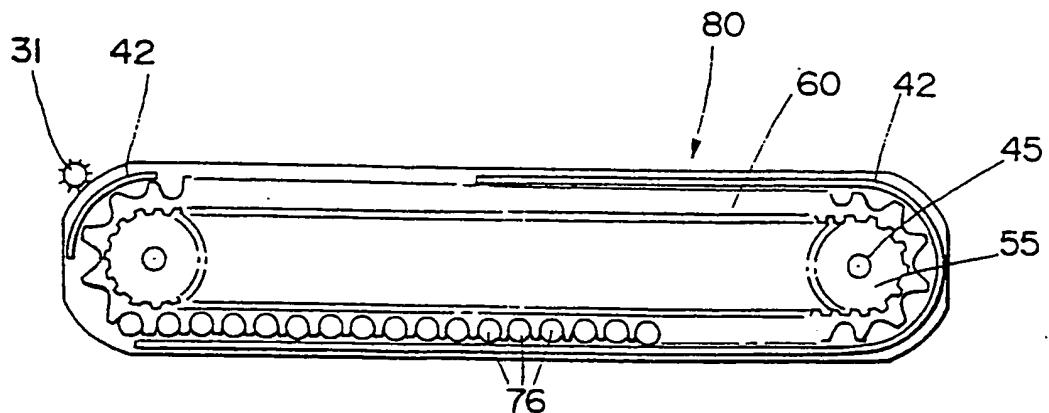


Fig. 14A

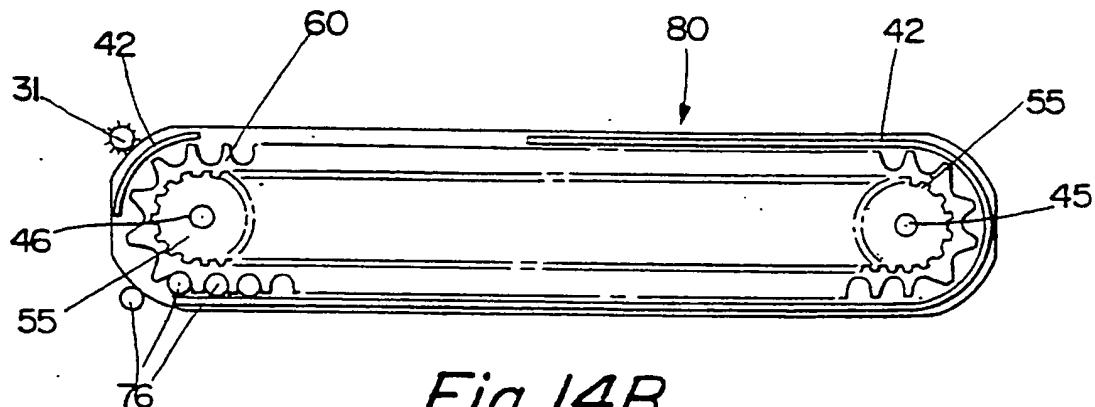


Fig. 14B

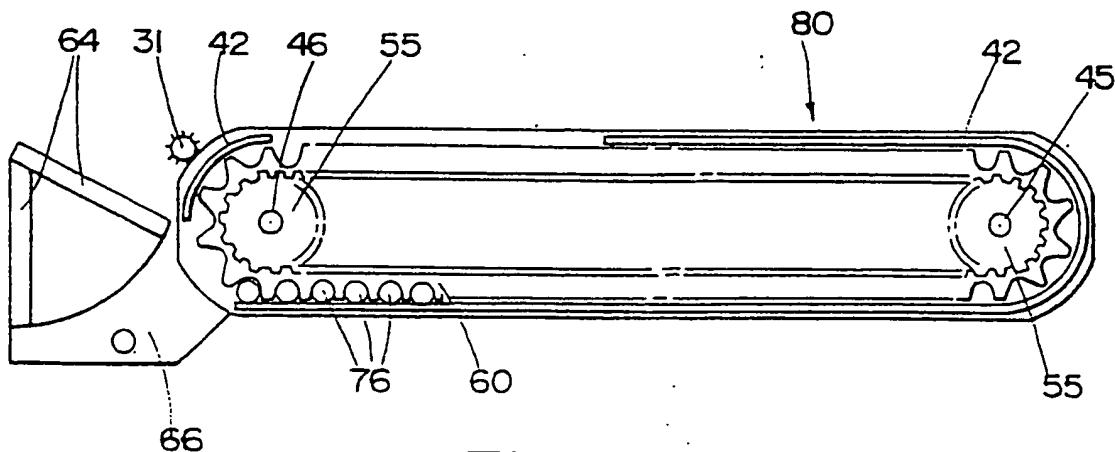
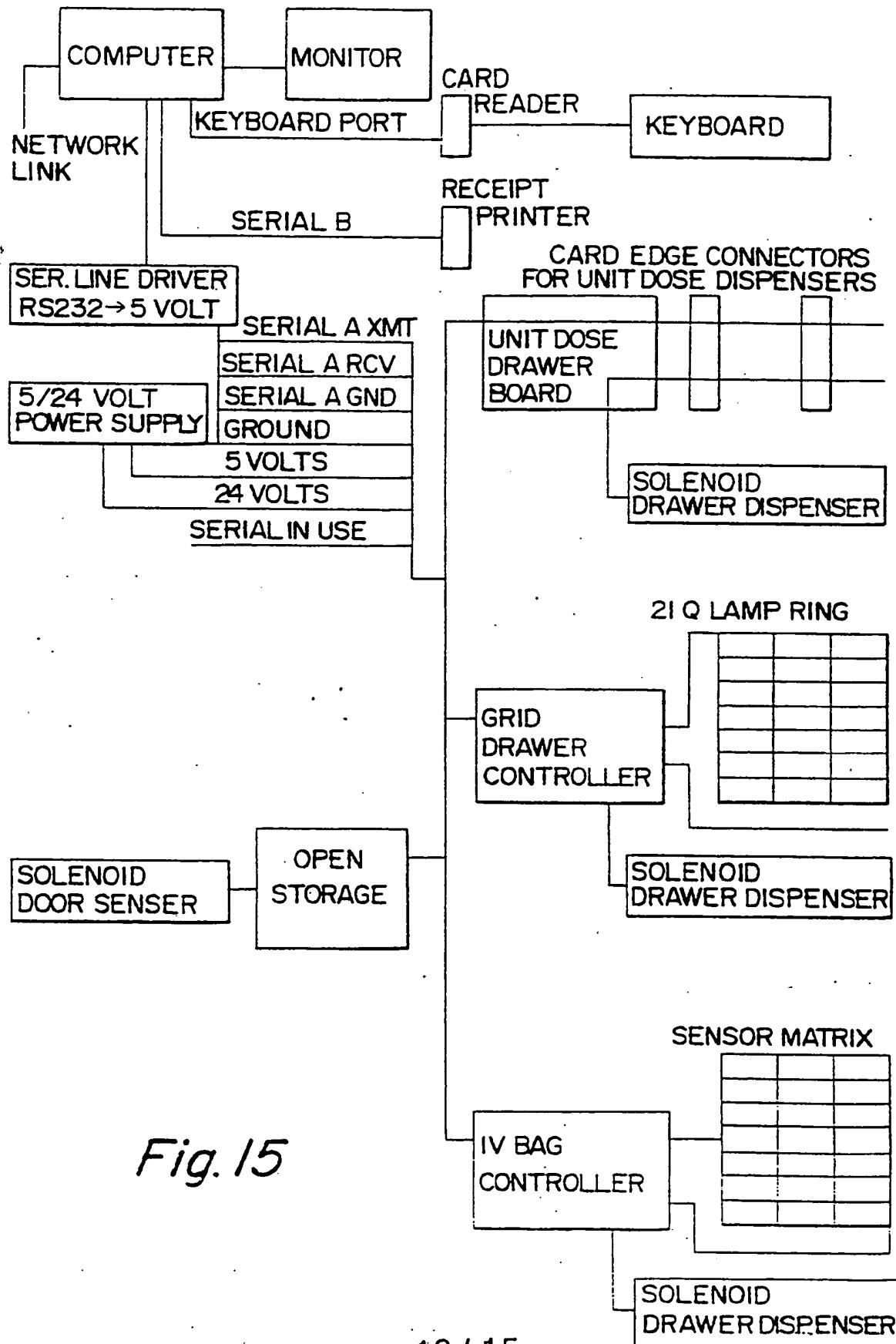


Fig. 14C

*Fig. 15*

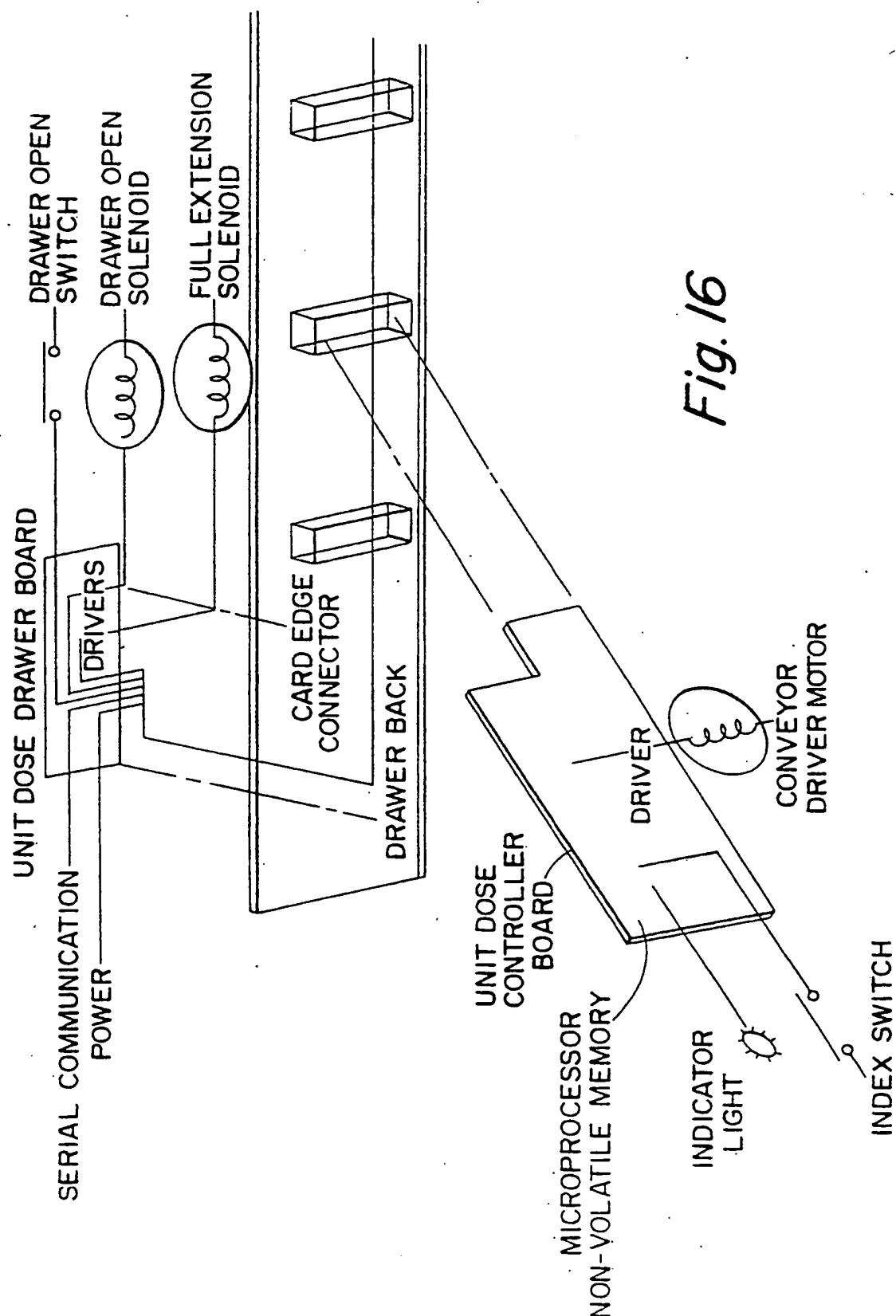
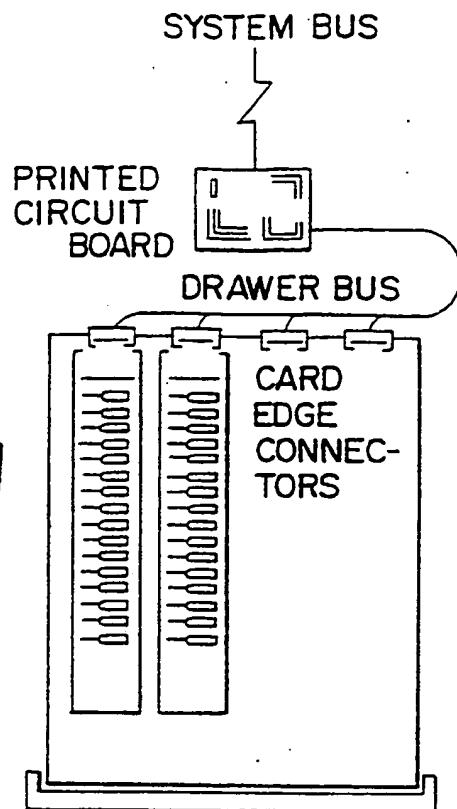
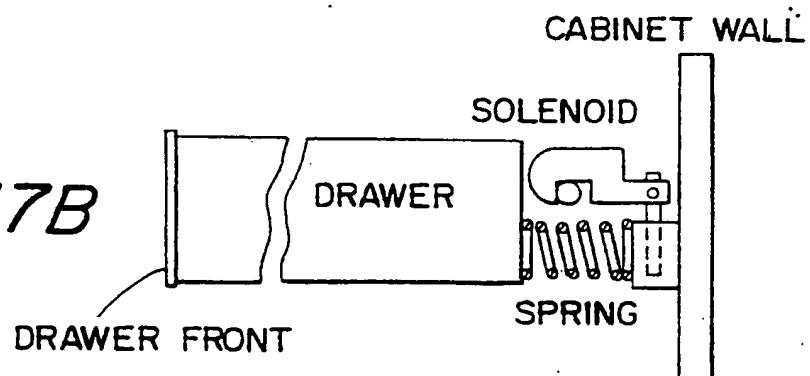
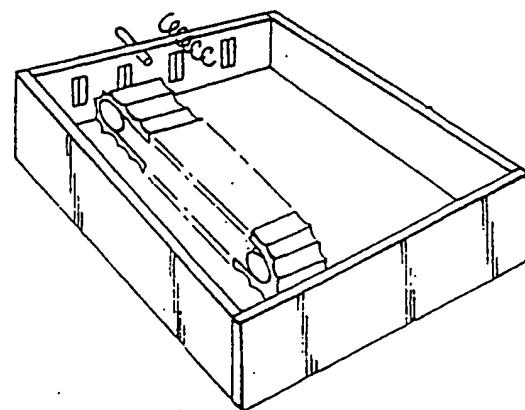


Fig. 16

*Fig. 17A**Fig. 17B**Fig. 17C*

INTERNATIONAL SEARCH REPORT

International application No.
PCT/US95/00943

A. CLASSIFICATION OF SUBJECT MATTER

IPC(6) :G07F 11/52

US CL :221/2, 7, 12, 76, 130, 131, 155, 253, 256

According to International Patent Classification (IPC) or to both national classification and IPC

B. FIELDS SEARCHED

Minimum documentation searched (classification system followed by classification symbols)

U.S. : 221/2, 7, 12, 76, 130, 131, 155, 253, 256, 6, 77, 97, 263

Documentation searched other than minimum documentation to the extent that such documents are included in the fields searched
Please See Extra Sheet.

Electronic data base consulted during the international search (name of data base and, where practicable, search terms used)

C. DOCUMENTS CONSIDERED TO BE RELEVANT

Category*	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
A	US, A, 3,253,736 (Moyer et al) 31 May 1966, entire document	1-64
A	US, A, 628,656 (Fisher) 11 July 1899, entire document	1-64
A	US, A, 3,606,959 (Stonor) 21 September 1971, entire document	1-64
A	US, A, 5,314,243 (McDonald et al) 24 May 1994, entire document	1-64
A	US, A, 4,722,058 (Nakayama et al) 26 January 1988, entire document	1-64
A	US, A, 4,274,551 (Hicks) 23 June 1981, entire document	1-64

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Date of the actual completion of the international search

24 MARCH 1995

Date of mailing of the international search report

18 APR 1995

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INTERNATIONAL SEARCH REPORT

International application No.

PCT/US95/00943

C (Continuation). DOCUMENTS CONSIDERED TO BE RELEVANT		
Category*	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
A	US, A, 5,321,625 (Humm et al) 14 June 1994, entire document	1-64
A	US, A, 3,722,743 (Atchley) 27 March 1973, entire document	1-64
A	US, A, 2,272,750 (Miller) 10 February 1942, entire document	1-64
A	US, A, 1,578,986 (Graves) 30 March 1926, entire document	1-64

INTERNATIONAL SEARCH REPORT

International application No.
PCT/US95/00943

B. FIELDS SEARCHED

Documentation other than minimum documentation that are included in the fields searched:

Baxter Healthcare Corporation, "The Way to Keep Your Medications on Course...", 1991.

Lionville Systems, Inc., "Access: The Next Level of Automated Drug Control", 7/1993.

Meditrol, "The Next Step in Pharmacy Automation", Undated.

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